



This is a digital copy of a book that was preserved for generations on library shelves before it was carefully scanned by Google as part of a project to make the world's books discoverable online.

It has survived long enough for the copyright to expire and the book to enter the public domain. A public domain book is one that was never subject to copyright or whose legal copyright term has expired. Whether a book is in the public domain may vary country to country. Public domain books are our gateways to the past, representing a wealth of history, culture and knowledge that's often difficult to discover.

Marks, notations and other marginalia present in the original volume will appear in this file - a reminder of this book's long journey from the publisher to a library and finally to you.

Usage guidelines

Google is proud to partner with libraries to digitize public domain materials and make them widely accessible. Public domain books belong to the public and we are merely their custodians. Nevertheless, this work is expensive, so in order to keep providing this resource, we have taken steps to prevent abuse by commercial parties, including placing technical restrictions on automated querying.

We also ask that you:

- + *Make non-commercial use of the files* We designed Google Book Search for use by individuals, and we request that you use these files for personal, non-commercial purposes.
- + *Refrain from automated querying* Do not send automated queries of any sort to Google's system: If you are conducting research on machine translation, optical character recognition or other areas where access to a large amount of text is helpful, please contact us. We encourage the use of public domain materials for these purposes and may be able to help.
- + *Maintain attribution* The Google "watermark" you see on each file is essential for informing people about this project and helping them find additional materials through Google Book Search. Please do not remove it.
- + *Keep it legal* Whatever your use, remember that you are responsible for ensuring that what you are doing is legal. Do not assume that just because we believe a book is in the public domain for users in the United States, that the work is also in the public domain for users in other countries. Whether a book is still in copyright varies from country to country, and we can't offer guidance on whether any specific use of any specific book is allowed. Please do not assume that a book's appearance in Google Book Search means it can be used in any manner anywhere in the world. Copyright infringement liability can be quite severe.

About Google Book Search

Google's mission is to organize the world's information and to make it universally accessible and useful. Google Book Search helps readers discover the world's books while helping authors and publishers reach new audiences. You can search through the full text of this book on the web at <http://books.google.com/>

2 45 0062 0148



LANE MEDICAL LIBRARY STANFORD

LANE

MEDICAL



LIBRARY

LEVI COOPER LANE FUND

*Presented to the Library of the New York Academy
of Medicine Dec. 18 - 1903,*

Clarence E. Skinner,

THERAPEUTICS

OF

DRY HOT AIR

LANE LIBRARY

BY

CLARENCE EDWARD SKINNER, M. D., LL. D.

Professor of Thermotherapy in the New York School of Physical Therapeutics;
Editor of the Department of Thermotherapy in The Journal of Advanced
Therapeutics; Physician in Charge of the Newhope Hot Air Sanita-
rium, New Haven, Conn.; Member of the American Medical
Association; American Electro-therapeutic Association; Char-
ter Member of the American Roentgen Ray Society;
Member of the American Association for the Ad-
vancement of Science; Connecticut Medical So-
ciety; New Haven Co. Medical Association;
Yale Medical Alumni Association, etc.



A. L. CHATTERTON & CO.

PUBLISHERS

8

Y9A9B1 39A1

COPYRIGHTED

BY

CLARENCE E. SKINNER

U865
S628
1902

DEDICATED
TO THE MEMORY OF THE LATE
DR. HEMAN BANGS SMITH
WHOSE PERSONALITY, RICH IN THE UNCONSCIOUS NOBILITY OF TRUE
MANHOOD AND OVERFLOWING WITH THE MILK OF HUMAN
KINDNESS, WILL ALWAYS BE RECALLED WITH
DEEP AFFECTION BY THE AUTHOR

PREFACE.

Dry superheated air as a therapeutical measure has now been before the medical profession for several years, yet as far as the average practitioner is concerned it is still a new and unknown quantity. Even the latest text-books dismiss it with but a mention and only in connection with two or three pathological processes. This general ignorance of the agent is to be deplored, as, when skillfully administered, it is one of the most potent and useful at our command and applicable to many diseased conditions wherein the ordinary methods of treatment are unsatisfactory.

In the following pages is set forth what has been ascertained in reference to hot-air therapeusis up to the present time. It has been considered desirable to mention briefly the other remedial measures which it is advantageous to apply to different diseased conditions in combination with this agent, because hot air is not an universal panacea. It is simply a rational therapeutical element which, alone or in combination with other remedial agents, will increase greatly our power to overcome pathological processes. In order to appreciate its true value, therefore, it must be viewed in its various relations, not alone. Where necessary to elucidate the manner in which hot air produces its effects, the pathological features involved in the condition under consideration have also been briefly noted.

Many of the failures to secure satisfactory results with hot air have been due to the fact that it has been called upon to

influence pathological conditions which were not amenable to its physiological action; others, more numerous still, have been due to faulty technique in its administration. These subjects, therefore, have been treated at some length.

It is not expected that every general practitioner will or can become a hot-air expert, but every physician should at least understand the principles of its application and the clinical results derivable therefrom, in order that he may be able to decide intelligently when his patient will be benefited by its use. If he does not care to undertake its actual administration he can send his patient to someone who is an expert.

Finally, too much must not be expected of hot air, or any other one measure. It will, alone and unaided, cure some diseased conditions; others will require all the therapeutical resources at our command; and in still others even all that we have will not suffice to produce a cure. Its powers, moreover, are exerted in directions in which remedial agents hitherto known have been very deficient; its addition to the treatment results in benefit to many patients who would fail to improve under other measures alone, and its adoption into our armamentarium enables us to increase by a large percentage the sum total of our power over disease. Any agent possessing these attributes is entitled to respect and study. Dry hot air possesses them in an eminent degree.

CLARENCE EDWARD SKINNER.

NEW HAVEN, CONN.,
October, 1902.

CONTENTS.

CHAPTER I.

APPARATUS.

Forms—General construction—Essential features—Maintenance of dryness of air in apparatus—Equalization of heat inside apparatus necessary, - - - - - 15-22

CHAPTER II.

PHYSIOLOGICAL ACTION.

Local treatment—Action predominantly local—Inhibitory influence when pathogenic germs are present in part treated—Reflex influence—General phenomena induced.
Body treatment—Action predominantly reflex through spinal sympathetic—Modifications produced in composition of blood and urine—General phenomena—Body temperature—Pulse—Respiration—Capillary circulation—Sensation—Stimulation of oxidation processes—Functional exaltation induced not followed by reactionary debility, - - - - - 23-28

CHAPTER III.

TECHNIQUE OF TREATMENT.

Two methods in vogue, with and without coverings—Function of coverings:
Local treatment—Form of coverings—Preparation of patient—Temperature of treatment—Preventing the wrappings from becoming ignited—Prevention of blisters—Applications to special parts—Length of application and after-treatment.
Body treatment—Coverings—Body area to be exposed to the heat—Pulse and temperature increase most convenient means for determining length and intensity of application—Phenomena indicating over-stimulation—Management of the same—After-care—Prevention of burns—Existence of valvular heart lesions and atheromatous arteries not contra-indicative of the treatment.
Knee treatment—Apparatus especially designed for this joint not as effective as general local application, but necessary when joint is markedly flexed and ankylosed, - - - 29-53

CHAPTER IV.

RHEUMATISM.

Importance of differential diagnosis—Diseases from which it must be differentiated—Action of hot air in removing causes of chronicity—Necessity of treating concomitant pathological conditions, - - - - - 54-56

CHAPTER V.

RHEUMATISM (CONT.).

Treatment—Technique of local application—Adjunctive measures—Selection and administration of medicines internally—The electrical currents—Diet—Chronic rheumatism—Treatment—Fibrous adhesions, - - - - - 57-62

CHAPTER VI.

SCIATICA.

Rarely a true rheumatism—Pathological characteristics of rheumatic sciatica—Modification of treatment of rheumatic sciatica from rheumatism in other situations—Nerve-stretching or other surgical measures are rarely necessary in true rheumatic sciatica—Curative power of hot air alone in rheumatism—Advantages exclusively dependent upon the use of hot air in rheumatism, - - - - - 63-67

CHAPTER VII.

SPRAINS.

Rapidity of recovery under hot air—Body treatment rarely called for—Treatment—Technique of hot-air application—After-treatment—Adjunctive measures—Electricity—Advantages exclusively dependent upon the use of hot air in sprains, 68-71

CHAPTER VIII.

ARTHRITIS DEFORMANS.

Hot air and static electricity the only measures that can be relied upon to give satisfactory results—Importance of diagnosis—Ætiology—Disease probably not rheumatic—Possible connection with conditions of nerve debility—Diagnosis, 72-81

CHAPTER IX.

ARTHRITIS DEFORMANS (CONT.).

Treatment—Technique of body application—Local application for relief of pain—Adjunctive measures—Electricity—Galvanism rarely useful in relieving soreness of joints—Drugs—Probable reason why the salicylates have acquired reputation in the treatment—Relapse of cases during first year after recovery, - - - - - 82-90

CHAPTER X.

ARTHRITIS DEFORMANS (CONCLU.).

Report of case illustrating characteristics and response to treatment of that form of the disease where involvement of the large joints only obtains—Case indicating that true bony ankylosis sometimes occurs in this disease—Advantages exclusively dependent upon hot-air therapy, - - - - 91-97

CHAPTER XI.

NEPHRITIS.

Probable primary ætiological factors—Local treatments useless in true Bright's disease—Prompt removal of symptoms by hot air—Permanence—Treatment—Technique of body application—Adjunctive measures—Diet—Electricity—Drugs—Advantages exclusively dependent upon hot-air therapy, - - - - - 98-103

CHAPTER XII.

LOCAL SEPTIC INFECTION.

Function of leucocytosis—Raising body temperature causes hyper-leucocytosis—Inhibitory influence of local treatment on germ growth—Illustrative case—Treatment—Hot air—Surgical measures—Advantages exclusively dependent upon hot-air therapy, - - - - - 104-109

CHAPTER XIII.

PNEUMONIA.

Pathology—Clinical results of hot-air applications with illustrative case—Disappearance of physical signs of consolidation in from one to five days, - - - - - 110-119

CHAPTER XIV.

PNEUMONIA (CONT.).

Ætiological and pathological features explaining action of hot air in pneumonia—Effect of inhibitory influence upon pneumococcus by local hot-air treatment—Why disease is not immediately aborted by hot air—Central pneumonia not as amenable as the ordinary form—Treatment—Technique of hot-air applications, local and body—Heart failure—Hyperpyrexia—Adjunctive measures—Drugs—Advantages exclusively dependent upon hot-air applications in pneumonia, - - 120-134

CHAPTER XV.

PERITONITIS.

Report of case illustrating effect of local treatment—Relief of pain by hot air—Variable ætiology—Treatment—Technique of hot-air applications — Surgical measures sometimes necessary, - - - - - 135-148

CHAPTER XVI.

PLEURITITIS AND SYNOVITIS.

Pleuritis—Variable causation—Enough cases have been treated to demonstrate the value of hot air—Treatment—Local and body hot-air applications.
 Synovitis — Causative influences — Tuberculous variety most resistant to treatment—Hot air effective in producing cure—Beneficial effect of hot air probably due to stimulation of local nutrition, not to directly destructive action upon the bacillus itself—Treatment—Local and body hot-air applications — Immobilization—Adjunctive measures—Electricity—General, - - - - - 149-155

CHAPTER XVII.

LITHÆMIA; NEURALGIA; MYALGIA; VARICOSE ULCERS.

Lithæmia — Restriction of term—Treatment—Diet—Body hot air—Electricity—True gout.
 Neuralgia—Importance of recognizing the causative factor—Treatment—Hot air—Electricity.
 Myalgia.
 Varicose ulcers —Causative factors—Local hot-air treatments—Body hot-air treatments—Electricity, - - - - 156-165

CHAPTER XVIII.

NERVOUS DEBILITY AND EXHAUSTION; NEURITIS; CHRONIC BRONCHITIS;
PULMONARY TUBERCULOSIS; FIBROUS ANCHYLOSIS.

Nervous debility and exhaustion—Definition of term—Object of treatment—Body hot-air application—Static electricity—Debility following acute infectious diseases.
Neuritis—Causation—Use of hot air—Electricity—Drugs—Diet.
Chronic bronchitis—Local hot-air applications—Body hot-air applications—Drugs.
Pulmonary tuberculosis—Only measures which have hitherto been useful are those which have improved general nutrition—Body hot-air applications of use in the treatment—Local application for the pleurisy—X-light—Ozone inhalations—Static electricity—Drug tonics.
Fibrous ankylosis—Beneficial influence of hot air in fibrous ankylosis—Electricity, - - - - - 166-175

CHAPTER XIX.

MISCELLANEOUS CONDITIONS.

Gall-stones—Report of case indicating beneficial influence of hot air and electricity—Gangrene—Angina pectoris—Body applications of hot air probably of benefit—Pseudo-angina—La grippe—Syphilis—Alcoholism—Care necessary during the administration of the body treatment—Dysmenorrhea—Myositis—Osteomyelitis—Periosteitis—Muscular adhesions—Skin diseases—Plumbism—Typhoid fever—Obesity, - 176-188

CHAPTER XX.

CONCLUSION.

Dry hot-air therapeutics yet in its infancy—Hodgkin's disease—Multiple neuritis—Tabes dorsalis, and other nervous diseases characterized by degenerative processes—Diabetes mellitus—Mental diseases—Infectious diseases—Erysipelas—Lupus—Surgical shock—Application to the external auditory canal, - - - - - 189-193

LIST OF ILLUSTRATIONS.

	PAGE
I. Lentz & Sons Apparatus for the Local Application of Dry Hot Air,	16
II. The Sprague Body Hot-Air Apparatus,	17
III. Patient undergoing Treatment in Sprague Body Hot-Air Apparatus,	17
IV. The Sprague Apparatus for the Local Application of Dry Hot Air,	21
V. Applying Turkish-Toweling Strips Preparatory to Local Application of Dry Hot Air to Knee with Special Knee Apparatus,	31
VI. Patient Prepared for Local Application of Dry Hot Air to Knee with Special Knee Apparatus,	33
VII. Local Application of Dry Hot Air to Knee with the Betz Special Knee Apparatus,	35
VIII. Patient prepared for Local Application of Dry Hot Air to Leg from Knee Downward,	37
IX. Local Application of Dry Hot Air to Leg from Knee Down- ward with Betz General Local Apparatus,	39
X. Patient Prepared for Body Dry Hot Air Treatment with the Betz Body Apparatus,	43
XI. Patient undergoing Body Dry Hot-Air Treatment,	45
XII. Patient Prepared for Local Application of Dry Hot Air to Left Lung or Pleuræ,	125
XIII. Local Application of Dry Hot Air to Left Lung or Pleuræ,	127
XIV. Patient Prepared for Local Application of Dry Hot Air to Abdomen,	143
XV. Local Application of Dry Hot Air to Abdomen,	145

THERAPEUTICS OF DRY HOT AIR.

CHAPTER I.

APPARATUS.

Three special forms of apparatus are essential in order that the most may be gotten out of dry hot-air therapeutics; a large one for treating the whole body at once; a smaller one for treating hands, wrists, elbows, shoulders, backs, abdomens, hips, ankles, and feet; and a short one, open at both ends, for treating flexed and ankylosed knees.

All of these consist in general of metal cylinders lined with some non-conducting material, and susceptible of being closed at both ends in such a way as to confine the air they contain about the part to be treated. Gas, gasoline, or electricity is used for heating, and high-temperature thermometers are placed conveniently for registering the degree of heat obtained.

There are several makes of apparatus on the market, the principle in all being much the same, but they differ in construction and price. In order that an outfit shall be capable of doing good work, it must conform to the following requirements.

The **body apparatus** should be capable of generating a heat of at least 300° F. in fifteen minutes and 350° F. in thirty minutes at the outside, and of sustaining it there indefinitely, and the source of heat should be so arranged that the flame cannot be directed toward the patient without having some non-conducting material interposed, however great the distance between them. It should be provided with valves, whereby the

air may be changed frequently without lessening the heat to any great extent. If free circulation of air in the apparatus is not attainable, it will become so saturated with moisture that the skin of the patient will be in danger of blistering. Because of its size and weight this form of apparatus is not portable,



Lentz & Sons' Apparatus for the Local Application of Dry Hot Air.

hence is available only when the patient can be brought to it, and in sanitariums and hospitals.

The medium-sized, or **general local apparatus**, is the one most useful to the general practitioner. A very important requirement is that it be portable, as it is frequently desirable to apply it at the bedside in acute diseases, as we shall see later. It should be capable of generating a heat of at least 400° F. in at most thirty minutes, and of sustaining it there indefinitely. The same conditions as to arrangement of



The Sprague Body Hot-Air Apparatus.



Patient Undergoing Treatment in Sprague Body Hot-Air Apparatus.

the source of heat in relation to the patient apply here as in the body apparatus, but with more force because the temperatures used are higher. An arrangement for securing free circulation of the air in the apparatus is essential.

The **knee apparatus** should conform to these requirements in so far as general construction is concerned, but for reasons which will be stated in the section upon technique, it need not be capable of generating so intense a heat.

It has been suggested that dryness of the air in the cylinder might be maintained by the use of some absorbent chemical, or by passing a static electrical discharge through a tube in the interior of the reservoir, thereby precipitating the moisture. By this means temporary irregularities of the temperature in the apparatus caused by changing the air would be avoided. To dispose of the point it is only necessary to consider that at the high temperatures necessary for therapeutical purposes, no chemical is known that would retain the moisture, even if it were possible for it to absorb it under these conditions, and however successful we might be in precipitating the moisture by electrical or any other means, it would inevitably vaporize again instantly upon coming in contact with a solid body so heated. Changing the air, therefore, is the only practical means now available for maintaining dryness.

A point of prime importance as regards efficiency in all these forms of apparatus is that the heat should equalize itself within narrow limits in all localities inside of the reservoir, after the apparatus is thoroughly heated. Schreiber conducted a series of thermometric observations with some hot-air machines of foreign make, and ascertained that a difference sometimes obtained between the temperature of the air which actually came in contact with the patient and that in the locality ordinarily occupied by the thermometer, of fifty per cent. of

the thermometer reading. A construction producing such conditions renders the apparatus entirely unfit for therapeutic purposes. The discrepancy should not exceed five per cent. of the thermometer reading with a body apparatus, or fifteen per cent. with one designed for local applications, and thermometric determinations made by the writer demonstrate that these limits need never be exceeded. In apparatus of American manufacture they are not usually reached. The simpler the design of the machine the more effectually will the convection currents effect a thermal equilibrium.

Apparatus for applying dry hot air to the open cavities of the body, as the external auditory canal, for instance, are procurable. As they have been but little used as yet, nothing conclusive can be said of their value, and their existence will be merely mentioned here.

Directions for setting up and operating the outfits are furnished by the manufacturers.



The Sprague Apparatus for the Local Application of Dry Hot Air.

CHAPTER II.

PHYSIOLOGICAL ACTION.

Local treatment.

The sphere of action of the local application is practically confined to the part treated. What slight effects are produced upon the organism as a whole are principally secondary to changes induced in the disease focus; hence it is not ordinarily capable of curing, unaided, pathology which owes its origin to impairment of the central nervous system. For instance, local treatments alone will not cure the joint lesions of arthritis deformans, because these lesions are but secondary manifestations of impaired trophic centers. They will in some instances, however, relieve the pain temporarily. In rheumatism, on the other hand,—and by this term I mean true inflammatory rheumatism,—the primary focus of infection is in the joint or joints affected, and local hot-air treatments with appropriate drugs will usually produce a radical cure. The organism at large will be secondarily benefited during the curative process by the lessening of depression due to pain, rheumatic toxins, and faulty products of metabolism, in proportion as the local lesion improves.

This therapeutical measure affects physiological function in two ways; first, by a direct stimulation of cell metabolism in the part treated due to the raising of its temperature *en masse*; and second, by a reflex acceleration of cell nutrition set up by the stimulating influence of the heat upon the numerous nerve endings in the skin.

It is of course not possible to raise the temperature *en masse*

of one portion of the body very much higher than that of another portion, but by placing the bulb of a clinical thermometer at the bottom of a deep sinus and then applying a hot-air treatment, it has been demonstrated that an increase of several degrees Fahrenheit can be induced. This is enough to accelerate oxidation processes very perceptibly.

In diseases characterized by the presence of pathogenic micro-organisms in the part treated, as local septic infection or pneumonia, the inhibitive influence of this element of the physiological action upon the growth and activity of the germs, whereby they are rendered more susceptible of attack by stimulated leucocytosis and cell metabolism, is very evident. It has been suggested that the germs in these cases were directly destroyed by the heat. This view, however, is improbable, and there is no experimental or clinical evidence available indicating that it is possible to raise the temperature of any portion of the body sufficiently high to produce this result.

Through the reflex influence is obtained an emphatic local hyperæmia, which, together with the stimulation of the trophic nerve supply of the part treated, results in greatly increased local nutrition.

Copious perspiration appears upon the region treated, and in greater or less degree upon the rest of the body. The secretion is strongly impregnated with fatty acids whatever the disease from which the patient is suffering, or even if he has no disease at all. If a toxin is circulating in the blood, a certain amount of it will be eliminated with this secretion.

To these profound influences upon the circulatory functions of the part whereby stasis is relieved, is probably due the powerful influence of dry hot-air treatments in relieving pain and swelling.

The general body temperature and pulse are but rarely much

affected. Patients frequently exhibit an increase of a fraction of a degree in the former, and eight or ten beats per minute in the latter, but nothing to influence the general metabolic functions markedly. That local hot-air applications are sometimes capable of exerting profound reflex influence upon distant parts, however, was demonstrated in a case reported by Walsh. The patient had eczema of both hands; one only was subjected to the treatment, yet both got well. Cases also have been reported where pains in a limb on one side of the body have been relieved while the corresponding limb on the opposite side was being treated.

It will be observed that all of these effects tend to greatly increase the assimilation of remedies in the tissues subject to their action.

Body treatment.

The physiological action of this measure is predominantly reflex through the spinal sympathetic, the area of skin treated being so great that the capillary circulation is able to dissipate the heat before it penetrates deeply enough to exert its action directly to any great extent, herein differing from the local application.

Microscopical and chemical examinations, made in connection with patients under treatment by the writer, have demonstrated that the following phenomena are susceptible of immediate induction by the body hot-air treatment.

First, the number of the white blood corpuscles is increased in different cases from fifteen to fifty per cent.

Second, the red blood cells are increased from ten to twenty per cent.

Third, the quantity of urine passed in the twenty-four hours succeeding the treatment is usually increased from twenty-five

to one hundred per cent. over that passed in the twenty-four hours preceding. In a few instances, however, a decrease in the quantity has been observed.

Fourth, the quantity of urea excreted in the twenty-four hours succeeding the treatment is increased from fifteen to sixty per cent. over that excreted in the twenty-four hours previous.

These effects persist, with decreasing intensity, for from four to forty-eight hours and sometimes longer, the time varying in different diseases and with different patients.

It will be observed from the above that the beneficial effect of body hot air is not entirely due to the induction of hyperidrosis and superficial hyperæmia, as is frequently stated, but that its influence involves phenomena of much greater profundity than would be explicable upon such an hypothesis.

When we consider the large number of pathological conditions in which the reconstructive functions are deficient, the modifications in the composition of the blood noted above assume an interesting significance; and when we think of the number and variety of diseases which are dependent wholly or in part upon the retention in the system of products of sub-oxidation, the sphere of action of the body hot-air treatment, as indicated by its effect upon oxidation and the excretory function, becomes extended within limits of considerable magnitude.

The general phenomena induced by the body application are as follows.

The mouth temperature rises from one to five degrees Fahrenheit, according to the length and intensity of the application, and the susceptibility to stimulation of the individual patient's deep nerve centers.

The pulse is accelerated from thirty to fifty beats per minute,

and is markedly increased in volume. If it was weak before treatment it now becomes strong. If the application is continued too long it loses its volume and strength, becoming rapid, small, and soft, but sometimes retains its volume, becoming very soft and slow. Under these conditions the patient becomes dizzy, faint, and nauseated.

The respiration deepens and the rate increases five to ten cycles per minute, but it is not accompanied by any oppression—rather the reverse, in fact.

The capillary areas become injected, but this phenomenon is not as marked in the regions actually in contact with the heat as with the local treatment. The fact that the capillaries of the face, which is never subjected to the heat, share this general distention even when constantly under the influence of the breeze from an electric fan, demonstrates the profundity of the reflex obtained.

The patient reeks with perspiration, the acidity of which is markedly increased over that normally exhibited.

The sensation is not disagreeable to the patient, but quite the reverse usually. A pleasant languor ensues after about ten minutes and lasts for an hour or two, and the patient usually becomes drowsy and sleeps. If the treatment is continued too long the languor gives place to exhaustion, with cardiac palpitation and oppressed breathing, which sometimes persists for hours.

By this profound stimulation of the deep trophic centers we secure a more rapid and complete oxidation of effete materials which are clogging metabolic processes, into normal excretory products,—urea for the kidneys, CO^2 for the lungs, etc.,—which are then easily disposed of by the appropriate organs, and a rapid production of more vigorous and healthier cell elements which are much better able than their predecessors

to resist toxæmia and microbic invasion. We not only obtain a corrective influence in nutritional disorders whose origin is in the deep sympathetic, but if the patient is suffering from an infectious invasion we increase vastly the resisting power of his phagocytes and tissue elements. The profuse perspiration carries out with it also a certain amount of ptomaines, and thus assists in relieving the depression of nerve centers due to systemic toxæmia.

The functional activity of every organ and tissue in the body is immediately augmented, but this exaltation of function is not followed by a reactionary debility. Patients frequently continue to improve generally for months after a course of body hot-air treatments.

It will be seen that the physiological action of hot air is in line with that of hydrotherapy, electricity, the Turkish bath, and massage, but under some conditions is much more profound than any of them. It is, however, usually advantageous and, as will be seen later, sometimes necessary to combine electrical modalities with hot air in order to accomplish certain results. Neither alone will do the work of both together. Massage in the same way is sometimes useful, but very rarely necessary.

CHAPTER III.

TECHNIQUE OF TREATMENT.

The difference between proper, thorough technique and the reverse frequently means the difference between success and failure in clinical results, hence this subject is a very important one.

There are two ways of giving treatments, with coverings and without. The latter method is based upon the assumption that the perspiration will be evaporated off from the skin by the high degree of heat as soon as it is formed; but, while this should be so theoretically, experience teaches that it does not always take place. A large proportion of it does evaporate immediately, and if a low degree of heat (250° F.) is used, this method is very satisfactory. But it is ordinarily necessary to employ greater intensities (350° F. to 450° F.) and then the sweat glands functionate so copiously that the secretion is not all vaporized immediately, and the residue becomes hot enough to blister. Applying a covering obviates this, because, as the covering invests the skin closely, it absorbs the perspiration as fast as it is formed, and attenuation of the secretion by distribution through the meshes of the fabric makes easy its conversion into steam by the heat, when it diffuses off into the air surrounding the part under treatment. The material for the covering should be loose-meshed and as absorbent as possible, and the cheap grades of Turkish toweling have given me greater satisfaction than anything else.

Local application.

For treating arms and legs and portions thereof the Turkish toweling should be cut into strips about seven inches wide and five feet long, hemmed and rolled like a surgical bandage. It is applied the same as a roller bandage, not tightly, but closely enough to obtain even and intimate contact between it and the skin. When the toweling is new three thicknesses will be sufficient, but when it is worn thin by use and frequent washing, four or five will be required. They should be boiled in soap and water each time after using.

It is well to have the patient remove all of his clothing and don a flannelette robe or suit of pajamas in which to undergo the treatment. He is thereby enabled to go home in dry garments instead of those dampened by perspiration.

After the wrapping has been applied there should be wound about it, paying especial attention to the creases and recesses, a line of tape with the turns about one inch apart. This will press the toweling down upon the skin where the bandaging has failed to do so, making the contact as perfect as possible. The limb is now ready to be placed in the apparatus, after which it should be again inspected to see that everything is in proper position, and the heat turned on.

The temperature should be allowed to rise steadily until the desired intensity is reached, where it may be maintained by regulating the heat supply. The office of the operator resolves itself, during the treatment, into changing the air in the apparatus often enough to maintain dryness, keeping the temperature steadily maintained at the proper elevation, seeing that the wrappings inside the apparatus do not get on fire, and in preventing the patient from being blistered.

The accomplishment of the first two objects is mostly a matter of keeping one's attention upon the task in hand. The



Applying Turkish Toweling Strips Preparatory to Local Application of Dry Hot Air to Knee with Special Knee Apparatus.



Patient Prepared for Local Application of Dry Hot Air to Knee with Special Knee Apparatus.



Local Application of Dry Hot Air to Knee, with the Betz Special Knee Apparatus.



Patient Prepared for Local Application of Dry Hot Air to Leg from Knee Downward.



Local Application of Dry Hot Air to Leg from Knee Downward, with the Betz General Local Apparatus.

moisture of condensation will necessitate changing the air in the cylinder pretty frequently during the first ten minutes, but after the apparatus has once become thoroughly heated no more inconvenience will be encountered from this source.

In reference to the third, it is well occasionally to smell of the air which escapes from the apparatus during ventilation, when the odor of the scorching cloth will be detected if danger is imminent. It is important to look out for this, as a patient who has once been burned will with difficulty be persuaded to take another treatment. If the cloth does ignite the first thing to do is to turn off the heat, then remove the patient's limb from the apparatus and dispose of the smoldering fabric. If the mischief is taken in hand as soon as the odor of combustion is detectable, there will be ample time in which to eliminate the difficulty before the fire penetrates to the skin.

As to preventing the formation of blisters. It happens not infrequently that even and intimate contact between covering and skin is not secured all over the part under treatment, or the patient's movements, which he should be warned to eliminate as completely as possible, may cause a wrinkle to form. Perspiration collects on the area of skin not in contact with the absorbent, its temperature rapidly rises toward the boiling point, and the patient complains of a burning sensation. If the perspiration is not removed, a blister will result. The operator can overcome the difficulty by introducing his hand into the apparatus and pressing the toweling down upon the complaining area of skin, when immediate absorption of the scalding sweat and relief will follow.

It requires a little practice to do this without burning one's hand. The "knack" consists in getting the hand in on to the part to be "pressed" quickly, and quickly out again without touching the sides of the apparatus. It is well for a

beginner to have a cloth glove to put on when he executes this maneuver. It will save him much discomfort and some blisters. The burning sensation and the danger of scalding the patient also obtain if the air becomes supersaturated with moisture; hence the necessity of securing free circulation through the apparatus.

For applications to the shoulder, back, abdomen, lung, or hip, the toweling should be cut in pieces eighteen or twenty inches wide and five feet long. When applied the piece should be folded twice, making three thicknesses, applied smoothly and held in place by cloth straps an inch broad passed around the body or portions of it in such a way as to maintain good and even contact between skin and covering, and then the apparatus connected. Heavy cloth attachments, so constructed as to fit these regions of the body, come with each apparatus.

The local treatment lasts an hour usually; less than this is not enough, and more does not increase the effect, under ordinary circumstances. After-treatment of the part, except wiping with a dry towel, is usually uncalled for, and passive manipulations, which it is frequently stated should follow all hot-air treatments, will in some conditions produce positive harm. Their use, therefore, should be governed by the conditions surrounding the individual case.

A proper acquaintance with and adequate attention to the technique of these treatments will render burns, scalds, and other accidents entirely unnecessary. Modifications of technique called for in different diseased conditions will be described in the sections which treat of these conditions.

Body application.

Loose bath-robos made of Turkish toweling constitute the best coverings to use during the body treatment. The patient



Patient Prepared for Body Dry Hot-Air Treatment, with the Betz Body Apparatus.



Patient Undergoing Body Dry Hot-Air Treatment.

may assume any position agreeable to him, but as it is necessary for him to remain quiet, and not move his limbs about during treatment, lying upon the back is preferable, unless deformities are present which render the position irksome. Small pillows are placed under the hollow parts of the body so as to give it support without strain. Boots made of the same material as the robe and coming to the knees are pulled on over the feet. The robe is then pressed down between the legs and arranged so as to hug the skin as closely as possible and the patient directed not to move his legs after this has been done. Enough medium-sized ordinary Turkish towels are then spread over feet, legs, and abdomen to form three thicknesses, the apparatus closed by dropping the curtain or curtains and tucking them in closely about the patient, and the heat turned on.

Just the right amount of covering to be used will be governed by the idiosyncrasy of the patient as regards profuseness of perspiration and nervous sensibility, and of the apparatus as regards the degree of heat used in the treatment, etc., but should be as little as is consistent with the safety of the integument. Very frequently the robe alone, which constitutes one thickness, will be sufficient. In other cases it will be necessary to cover a portion only of the body, as the feet, abdomen, or thighs, with the extra towels. The patient's sensations are a pretty safe guide in the matter.

The body area exposed to the heat should usually be the feet, legs, and abdomen up to a point midway between the umbilicus and the nipple line, but it may be extended to embrace the whole body up to the neck, in which case Turkish-toweling mittens are drawn over the hands. The factor which determines whether or not the whole of the body up to the neck shall be subjected to the influence of the treatment is the

degree of response obtained from the nerve centers during the séance, and this also governs the length and intensity of the applications. Different individuals exhibit different degrees of susceptibility to thermic stimulation, and each patient must be handled according to his own law. Observation and experience have shown that this factor is tangibly and conveniently expressed under ordinary circumstances by the degree of acceleration of the pulse and increase in the body temperature, which, as we have seen when considering the physiological action of the measure, accompanies its application. The modifications in the character of the respiratory phenomena are characterized by so much irregularity that they possess no value as indices of responsiveness to stimulation.

The pulse and temperature, then, being adopted as guides, it becomes necessary to know the degree of acceleration and increase beyond which it is unnecessary to go, but which must be attained in order that the amount of deep reflex response which will produce the best results may be known to have been induced; and from a study of three thousand body treatments given under my personal supervision I have adopted as a working rule—which is modified in individual cases according to indications—the plan of treating the patient until his pulse has reached 120 beats per minute, or his mouth temperature is 2° F. above the normal. One of these conditions will be attained first in one patient, and the other in the next, but the occurrence of either one usually means that a sufficient influence has been secured and that the time has come to stop the treatment. I will say here that the mere induction of perspiration, however profuse, is not an indication that this object has been attained. Comparatively low degrees of heat will often do this. What we want is the deep reflex response, hence the necessity of intelligently thorough treatment. Patients not

treated up to this point do not get their due in the way of benefit, and if it is carried much farther the sympathetic centers ordinarily show signs of exhaustion, which is just as bad. Sometimes it will take fifteen minutes, sometimes an hour.

Other phenomena sometimes induced during treatment, and which demand attention, are nausea or retching, faintness, laryngeal cough, oppression of breathing, headache, cranial throbbing, ringing in the ears, uncertainty or partial loss of vision, and mental confusion. The first four are usually evidences of hyper-excitability of the nerve centers and are ordinarily met with only in hysterical subjects. The occurrence of the others indicates cerebral congestion, and usually means that the limit of treatment duration and intensity consistent with the patient's best good has been reached. All of these phenomena are evidences of relatively excessive stimulation.

The remedy consists of the application of an ice-cap to the patient's head, which, with moderate fanning of the exposed portions of the body, will usually take care of the situation perfectly. If they persist in spite of these, the heat should be turned off at once and the patient cooled. At the next séance run the temperature up more slowly. I have seen but one patient who could not take the limit, if handled well, and he was a victim of angina pectoris. The pain was always provoked when the pulse rate reached 110, but it always subsided kindly on turning off the heat. I shall mention this case later.

Water may be given at any time during the treatment in dessertspoonful doses every thirty seconds if the patient develops thirst, but should not be administered in large quantities at once.

The after-care of a patient who has had a thorough body treatment is important. My custom is to leave him in the closed apparatus for ten minutes after stopping the

heat, then open the apparatus and allow him to cool, exposed to the air of the room for twenty minutes. Usually, by this time, the temperature and pulse will have returned to the normal. The pulse usually subsides more slowly than the temperature, but the patient should not be allowed to rise until it has nearly or quite reached the rate which obtained before treatment, or syncope is liable to result. One of my early patients frightened me sorely before I had learned this point, by falling in a heap on the floor, unconscious and cyanosed, on her way from the apparatus to the bath. I had gotten her up too soon.

When the pulse has subsided the patient may rise to the sitting posture and see if the exertion causes nausea or dizziness; if it does, he should lie down again for ten minutes more. If not, he may slowly and deliberately leave the apparatus and sit in a chair, preferably one which can be instantly adjusted to the reclining position if any giddiness or nausea is provoked. If neither of these symptoms appears in three or four minutes, he is ready to be taken to the tepid bath, well soaped, rinsed, and put to bed. He should then have a thorough rubbing with alcohol and be left to sleep or rest for an hour, after which he may dress. In some diseases characterized by a marked element of nervous debility, as arthritis deformans or various neurasthenic conditions, it is well to prolong the period of rest to two or three hours.

As regards scalds, burns, etc., the same cautions and means of prevention apply here as in the local treatments. If changing the air or pressing the covering against the skin does not relieve the "burning" sensation, open up the apparatus and spread another towel over the spot. No matter what apparatus is used, if the heat is intense enough blisters are liable to obtain, and constant care should invariably be exercised.

The belief is entertained by many that patients with atheromatous arteries and valvular heart lesions should not be subjected to the body hot-air treatment. This is a fallacy. My observations have given me reason to believe that atheromatous arteries are softened and rendered more functionable by the use of this therapeutical agent, through the absorption of lime salts deposited in their walls and at least partial regeneration of normal connective tissue elements, and I have repeatedly treated patients who have had previously one and two cerebral hemorrhages with none but beneficial results. In treating patients so afflicted, it is well to run the heat up slowly during the first three or four treatments, watching the effect carefully meanwhile, but I have never encountered the slightest cause for anxiety with them any more than with others, when carefully handled.

Knee application.

The apparatus designed especially for treating this joint is the least useful of the three. At first sight it would seem to be particularly well adapted for its purpose, but when it is attempted to utilize it practical difficulties present themselves. In this apparatus the leg is supported by a canvas or denim strip passing from side to side in the interior of the hot-air reservoir, upon which it is designed that the posterior surface of the joint shall rest. It will be found that when the heat begins to run up the perspiration will run down and soak into the wrapping about the popliteal space, and be confined there by the pressure of the canvas strip under the weight of the leg. Instead of being rapidly diffused off into the air in the cylinder it remains in contact with the skin, and the constant steaming produced will render it impossible to secure the desired intensity of heat without blistering. It was attempted to

obviate this difficulty by having two vertical supports made, one to be placed at the distal and the other at the proximal side of the apparatus and entirely external to it, upon which the leg should rest. By this means it was possible to do away with the supporting strip inside of the reservoir, and the conditions were considerably improved. Blistering was still uncomfortably frequent, however. Finally I discarded the knee apparatus altogether and substituted the general local apparatus with eminently satisfactory results, much better than with the one especially designed for the joint.

Knee joints which it is desired to treat with hot air, however, are sometimes ankylosed in the flexed position, which renders it impossible to get the joint into the general local apparatus. The special knee apparatus then becomes of necessity the only one available. The joint is wrapped with three thicknesses of Turkish-toweling strips for a distance extending about ten inches above the patella and the same distance below this point. The foot is then carried through the cylinder until the knee joint is directly above the source of heat and resting upon the hammock. The flexible attachment for closing the distal end is fastened about the limb six or eight inches below the knee and that for the proximal end the same distance above. The heat is then turned on and run up as high as the patient's tolerance will permit; for the reasons just stated this will rarely be more than 275° F. This degree of heat is much less efficient than 350° F., and not infrequently it will fail altogether in producing the desired therapeutical results.

The fact that an efficient special knee apparatus is not at present available is not of as much importance as would at first thought be supposed. The class of arthritic affections in which the general local apparatus cannot be used in treating this joint

is, as will be seen later, that in which local repair is best obtained through restorative influence exerted upon the general system, and the body treatment renders the use of local applications unnecessary. It is to be hoped, however, that some efficient means of applying the agent in this situation will be evolved in the future, for the sake of those patients who are not within the reach of a body apparatus.

The frequency of administration both of the body and local applications varies with different diseases and conditions, and will be indicated in the sections which treat of them.

CHAPTER IV.

RHEUMATISM.

By this term is meant true inflammatory rheumatism. Three years ago in an article concerning dry hot air, the writer expressed the opinion that "a new leaf" was about to be turned in the history of the clinical results of rheumatism therapeutics, and subsequent experience has justified the inference then noted. It is in this disease that the agent has won its most enduring laurels up to the present time. Its mode of application and the results therefrom are now well defined, and the treatment of the disorder has reached a point where it can no longer be regarded as a reproach to the profession. The extinction of an attack can be as satisfactorily and positively accomplished as can that of any other disease, not excepting malaria.

One of the most important points to be taken into consideration in judging of the efficacy of hot air, or any other element of treatment in this disease, is the very common error of diagnosing as rheumatism, conditions of an entirely different nature. The frequency of the error may be appreciated when I say that at least three-quarters of the cases that have come under my observation with a diagnosis of rheumatism have not been rheumatism at all, and further have involved the practical point that they are disease processes which do not respond to anti-rheumatic therapeutics.

This makes the correct diagnosis of a condition presenting rheumatic phenomena of the first importance, and as anti-rheumatic treatment is not only futile, but occasionally positively injurious in some other conditions closely resembling this

disease, the diagnosis should be made before treatment is instituted. Rheumatism has been made to bear a vast deal of undeserved opprobrium.

The more important conditions from which it is to be differentiated are as follows: arthritis deformans; neuritis; neuralgias; myalgias; tubercular, syphilitic, gonorrheal, and traumatic osteitis and periosteitis; synovitis; phlebitis; and non-rheumatic myositis, which is of rare occurrence, but sometimes offers a diagnostic problem puzzling in the highest degree. Pressure from tumors, especially those occurring in the retro-peritoneal lymphatics and which involve the nerve trunks and plexuses in these vicinities, orthopedic deformities,—as flat foot,—and the occupation neuroses in their earlier stages, deserve a much greater amount of consideration than is generally accorded to them.

The two first-mentioned diseases are concerned in by far the greater number of diagnostic errors, and it is in these also that early diagnosis is of great importance, as will be seen when their respective treatments are discussed.

It is necessary to divide rheumatic cases into but two classes for therapeutic purposes—acute and chronic. If the acute stage is properly and thoroughly managed there will very rarely indeed be any chronic stage to consider, but this could not have been affirmed before the advent of hot air. The cause of chronicity has resided mostly in the impairment of local and general metabolism through the influence of long-continued pain, and the long-continued presence in the blood of rheumatic toxins, by reason of which it became impossible for the remedies ingested to be assimilated effectively by the tissues wherein the pathological focus existed. Hot air, through its power of relieving stasis and stimulating sluggish metabolism, renders rapid and effective the assimilation of the

appropriate remedies, the general trophic centers are not subjected to drug, pain, or unendurable toxin depression, and recovery is rapid and satisfactory.

It is hardly necessary to state that other pathological conditions which may exist when an attack of rheumatism is sustained should receive attention. Sometimes the system is so depressed by these that the rheumatism cannot be removed until they have been attended to. I once had a patient under treatment for rheumatic poly-arthritis for three weeks, and was able to secure only temporary benefit. At last I discovered that she had a tapeworm, a fact of which she had previously had no suspicion. After the removal of an eighteen-foot parasite her recovery was immediate and perfect.

CHAPTER V.

RHEUMATISM—(*continued*).

Treatment.

Hot Air.

The local application of hot air is usually sufficient in rheumatism. If more than one joint is affected as many as possible of them should be treated at once with as many separate apparatuses. The body treatment is always useful and occasionally necessary for removing metabolic impairment from systemic toxæmia and debility, but for the routine treatment of the disease it is not usually essential. The local treatments should be applied at least twice a day at a temperature of 400° F. for an hour, until soreness and pain in the parts have entirely disappeared. When the pain returns after the treatment the same may be applied again immediately. Usually fifteen or twenty minutes will entirely remove the pain from the most violent cases, and it remains quiescent for a variable period, ordinarily six or eight hours. By repeating the application whenever the pain returns the patient can be kept practically free from marked discomfort during the whole of his convalescence, the inauguration of which usually coincides with his first hot-air treatment.

Rest of the affected joint is always helpful, but not always absolutely necessary. Massage or other after-treatment is ordinarily unnecessary and sometimes interferes markedly with the patient's comfort, either immediately or shortly afterwards. The limb may be done up in absorbent cotton or flannel, but

liniments or other external applications are usually uncalled for and useless.

Adjunctive Measures.

Drugs.

Salicylic acid in some form should always constitute the principal element in any anti-rheumatic treatment. There can be no doubt that it is as nearly a specific for rheumatism as any drug is for any disease, but because of its irritative tendencies towards the stomach and kidneys and its depressing influence upon the heart, it sometimes so impairs assimilation and metabolism, either general or local or both, that it destroys its own effectiveness by rendering impossible its ingestion in sufficient quantity. By the use of hot air, however, local metabolism is kept at its point of greatest activity, and assimilation is rapid and complete. Less of the drug is therefore required to be introduced into the general circulation, and less systemic disturbance ensues therefrom. As a matter of fact, when hot air is administered in conjunction with the proper salicyl compound systemic disturbance of any sort or degree is of extremely rare occurrence.

The selection of the salicyl is important. Those most worthy of consideration are aspirin, salicin, sodium salicylate, salophen, and methyl salicylate, and their desirability according to my experience is in the order in which they are named.

Aspirin in doses of 3 or 4 grams per day is usually a perfectly effective anti-rheumatic, and very rarely indeed produces any irritation of the stomach or kidneys or depression of the heart. Occasionally slight tinnitus or heart-burn follows its use, and rarely a patient is encountered who cannot take it at all.

Salicin is nearly as effective, but must be given in much larger quantities (10 to 15 grams daily), and the bulk is ob-

jectionable. Salicin has the advantage over all the others of being an excellent stomachic, and constitutes a most useful succedaneum to sodium salicylate when the latter drug has impaired digestion. It serves admirably to remove the gastric debility as well as to keep up the salicyl saturation of the blood.

The gastric and renal consequences of administering sodium salicylate in full doses need only be mentioned in order to be appreciated, but in cases where it is tolerated no drug does better work.

Salophen may safely be given in gram doses three times daily and does good analgetic work for a day or two, but in order to get a marked and sustained curative action larger quantities are usually required, and then the heart is apt to suffer. It is, however, extremely valuable in some cases, and I shall refer to it again in connection with sciatica.

Methyl salicylate is sometimes given by the mouth, but my experience has been that its use is preferably restricted to external application after hot-air treatments with those patients who cannot take any of the others in sufficient doses per os. Three or four thicknesses of gauze are laid smoothly over the joint affected, 5 or 10 grams of methyl salicylate soaked in it, and gutta-percha tissue wrapped around the whole and retained in place by a roller bandage. It enters the circulation by absorption through the skin.

It will not frequently be found necessary to go beyond aspirin. This drug is not miscible with water, but by thoroughly incorporating it with an equal quantity of powdered sugar it may be suspended in the liquid, and is best given in this manner.

The practice of administering alkalies in this affection with or without a salicyl compound is a common one, but modern conceptions of the pathology of the disease do not furnish a

logical indication for it, and although it does no harm, I have never been able to convince myself that it did any good, and have abandoned it.

In chronic cases where pain is not a factor demanding immediate attention, it is well to precede the first hot-air treatment by two or three doses of the salicyl selected. We thus secure a preparatory saturation of the patient's system and the case progresses more rapidly thereafter. In acute cases, however, immediate relief of the constant harassing pain is imperative, and the hot air should be given at once.

Electricity.

The electrical currents usually play but a secondary part in the treatment of this affection when hot air is available. Occasionally a case is encountered, however, where a muscle remains sore upon movement after the attack has apparently entirely ended, and here a few applications of the negative pole of the galvanic battery over the complaining region will dissipate the trouble. When hot air is not at hand, they are extremely useful, and may be applied as follows.

Static.

The spray over the spine for its general tonic effect, and the brush discharge for from thirty to forty minutes over the seat of the inflammatory process for sedation, relief of swelling, and improvement of metabolism.

Faradic.

Rapidly interrupted current from long, fine-wire coil passed directly through the tissues affected, for sedation and improvement of metabolism.

Galvanic.

Usually the positive pole over the affected tissues will give temporary relief from the pain and should be tried

first, but sometimes the polarities must be reversed to obtain this result. We can tell which only by trying. In addition to its sedative action the galvanic current exercises a curative influence upon the disease through its power of stimulating tissue metabolism. Its action in this direction is probably identical with that of hot air, but much less powerful. When the part affected is a hand, foot, wrist, or ankle, the use of a water-bath electrode in which the member can be immersed is much more effective. From 5 to 15 milliamperes may be used for from ten to fifteen minutes.

Franklinism is the most useful of the electric currents in rheumatism.

Diet.

Rigid restriction of the diet within narrow limits in this disease is not of nearly as much importance as is ordinarily supposed. Its regulation should be governed by the manifest needs of the patient's economy and the effects of the unaccustomed conditions surrounding him as regards lack of exercise, etc., rather than by the mere fact that he has rheumatism. The disease has in the past been so inextricably entangled with lithæmic and gouty conditions that the diet has been made to assume an unduly specific character. The patient should be fed as would a person sick with any other disease which had impaired his power of digestion and assimilation, and whose muscular and nervous systems were weakened by fever and sluggish from lack of exercise. If his digestive powers are equal to beefsteak it may be given him without fear.

As in every other general infection the bowels must be kept freely open, and salines are the best agents to employ for this purpose. Plenty of liquid in the form of milk (one quart per

day), water,—carbonated or plain,—or lemonade, is essential for the patient's best good.

Chronic rheumatism.

The treatment differs very little from that of the acute form. As pain is not so prominent a feature the treatments do not need to be repeated so frequently, and the response on the part of the patient is usually quicker and more complete. Electricity in the form of the static spark, static wave current, and galvanism, is always useful in conjunction with hot air, and when the thermal agent is not available forms the physical means most to be depended upon. The drug treatment differs in no particular from that of the acute form.

Fibrous adhesions, so called, which are ordinarily looked upon as forming a prominent element in the pathology of chronic rheumatism, usually yield kindly but somewhat slowly to the absorptive influence of hot air. Personally my experience has been that true fibrous adhesion following true uncomplicated rheumatic inflammation is one of the rarest of occurrences, so much so in fact that when it is encountered as an alleged post-rheumatic lesion I think the diagnosis of the original condition should be subjected to close scrutiny. We may get an impairment of function due to plastic exudate which simulates very closely the graver condition, but is not true fibrous adhesion. This hypothesis would account for the satisfactory way in which the condition responds to hot air. This agent removes the ankylosis due to confinement of a joint in a splint after fracture, for instance, which we know to be due to true fibrous adhesion, in quite a different manner from that following true rheumatism.

CHAPTER VI.

SCIATICA.

This condition is more frequently a neuralgia or a neuritis than a rheumatism, and it results from intra-pelvic neoplasms involving the sacral plexus oftener than is generally supposed. When rheumatic infection does attack this nerve, however, the resulting condition presents distinctive clinical and pathological features which are sufficiently pronounced to demand a marked modification of treatment in many cases, and for this reason it is entitled to a special mention. The distinctive pathology consists of a true interstitial neuritis set up by and accompanying the rheumatic inflammation of the connective-tissue elements, and this sometimes persists so as to keep up pain and soreness in the part for weeks and months after the rheumatism has subsided. The same conditions may be induced as in a traumatic or any other neuritis, viz., swelling of the nuclei in the sheath of Schwann, which by pressure upon the axis cylinder causes interference with its function and sometimes death at the point of pressure, followed by degeneration of the axis cylinder peripherad. Hence we get the atrophy of groups of the leg muscles, so frequently seen in sciatica. Therapeusis must therefore be addressed to the element of neuritis as well as the rheumatism.

The treatment of the early stage should be the same as for rheumatic inflammation anywhere, viz., rest, local hot air to the affected hip, and some salicyl compound, and it has seemed to me that salophen usually gave better results in sciatica than any of the others. The body treatment every two or three

days is of great assistance in this condition, through its influence upon general metabolism.

The principal modification of treatment, however, consists of the addition of the electrical currents. As before stated, they play but a secondary part in the treatment of acute rheumatism elsewhere when hot air is obtainable, but in sciatica they are always of great service and sometimes cannot be dispensed with.

Static.

For recent cases the brush discharge for twenty or thirty minutes, or the wave current, localized over the nerve back of the trochanter and as far as the inflammation extends down the thigh, for the same length of time, once or twice daily until the acute stage has subsided, does good service.

For the chronic cases, long, thick sparks over the course of the nerve, or counter-irritation with the massage roller or brass-ball electrode, may be alternated with the wave current every day or two. Sparks must be applied cautiously, as they will aggravate the trouble if used too soon, and some cases will be aggravated by them at any stage. In chronic sciatica, however, judiciously chosen and applied static modalities are of more value than all the other measures put together, with the sole exception of hot air, and these act extremely well in combination; static in the morning, hot air at night, or *vice versa*. The immediate relief of pain which usually follows static and thermal applications in these cases is one of the happiest of therapeutical experiences. The tonic action of franklinism upon the system at large is strongly in evidence under these conditions.

Galvanic.

Opinions vary as to the advisability of using the galvanic current in acute sciatica, and, as a matter of fact, when

hot air or static are available it will seldom have to be considered at all. The immediate relief of symptoms due to its application is unquestionable, but this is frequently followed, after some hours, by an aggravation of the same. In cases where these agents cannot be used, however, and even in some cases where they can, galvanism is useful, and may be administered as follows.

The positive pole should usually be applied, stabile, over the point of exit of the nerve from the pelvis, and the negative, labile, over the course of the nerve as far down as the pain extends. This usually means clear to the toes, and the current strength should be from 5 to 15 milliamperes, according to the patient's tolerance, for ten or fifteen minutes. Stronger currents are extremely likely to produce irritation enough to aggravate the symptoms. Very rarely in acute cases, but more frequently in chronic, the reversed polarities give better results, both as to sedation and permanent benefit. It can be ascertained which only by trial.

Faradic.

The rapidly interrupted current from the long, fine-wire coil acts powerfully as a sedative in this condition, but rarely accomplishes anything else.

It should be remembered that in some cases of this disease any application of any electric current will make the condition worse at any stage of the trouble, with the exception of the static wave, which I have never known to cause, or heard of causing, anything but benefit. It is needless to say that, when such a case is encountered, electricity should be kept religiously away from it.

Nerve-stretching or other surgical measures are rarely, if ever, called for in true rheumatic sciatica. Personally I have

never seen a case that would not yield to the remedies hereinbefore mentioned. Unfortunately this cannot be affirmed of all the other inflammations and irritations that attack this nerve.

The question is sometimes asked, "Will not hot air alone cure rheumatism, without drugs?" Unquestionably in some cases, but in the vast majority it only temporarily relieves the pain. Some cases will get well without any treatment at all, but that does not justify restricting routine treatment to giving full play to the *vis medicatrix naturæ*. Hot air alone will not do what it will when combined with drugs, and drugs alone will not do what they will when combined with hot air. When both are given together we know that recovery will quickly follow; when one alone is employed the recovery, duration of attack, and condition of patient, during and after the same, are all more or less problematical. It can hardly be considered fair to the patient, or wise from a professional standpoint, to fail in giving him the benefit of all the therapeutical resources at our command.

The advantages exclusively dependent upon the use of hot air in rheumatism are as follows.

First, immediate relief of pain however severe, which relief may be rendered permanent by repeating the treatments as often as the pain becomes troublesome; every four hours, if necessary.

Second, **shortening** of the duration of the disease, which usually lasts only from five to ten days when hot air is thoroughly administered in combination with well-chosen drugs.

Third, lessening of the liability of cardiac involvement because of the rapid control obtained over the condition, whereby the infection is inhibited from further attacks upon other tissues.

Fourth, lessening of the number and quantity of the medicines which it is necessary for the patient to ingest, because of

the increase produced in the efficiency and intensity of their action at the seat of infection; hence rendering it possible to avoid drug intoxication.

Fifth, in most cases which prove intractable to other measures its employment will render possible the extinction of the trouble.

Sixth, when properly and judiciously applied, its use is never productive of any vicious after-effects; on the contrary, the patient's general condition is immediately and greatly improved.

CHAPTER VII.

SPRAINS.

In the treatment of these injuries hot air is as effective as it is in rheumatism. In nine cases out of ten, if a sprain is gotten under treatment by this agent within four or five hours after the injury, all traces of the trouble will have entirely disappeared in from two to four days. When we consider the ordinary course of repair in sprained joints under ordinary treatment, the significance of the above statement can be appreciated. Instead of weeks of painful confinement we have days, and as the pain is relieved immediately, the patient does not suffer. These two results of its application entitle hot air to a place in the first rank of remedial measures for this condition, if not to the first place.

As a sprain is usually sustained while the victim is in good health and as the lesion is not an infective one, there is no impairment of the general metabolic functions, hence the body treatment is rarely called for in recent cases. In older cases, where the central nervous system has felt the evil influence of long-continued pain and loss of sleep, or in patients exhibiting a low grade of vitality, the body treatment is extremely and rapidly helpful, but ordinarily the local is all that is required.

Treatment.

A sprained joint rapidly becomes extremely sensitive to manipulation that disturbs the lacerated connective tissues about the ligaments, and when one comes under treatment, however early, the slightest movement will usually cause

excruciating pain. Hence the wrappings should be applied deliberately and with the utmost gentleness, and in pressing the wrappings against parts that complain during treatment, this should be borne in mind. The application should be continued for an hour and the degree of heat should not be less than 350° F., and in some cases will need to be pushed to 450° F. or 500° F. If the joint is superficial, the patient fairly thin, and little cedema is present, 350° F. will usually be sufficient; if, on the other hand, the injured structures are covered by large muscles or a thick layer of adipose or cedematous tissue, it will require from 450° F. to 500° F. The first twenty or thirty minutes of treatment will usually entirely relieve the pain while the joint is at rest, and I have never seen a case where it persisted for the whole hour.

After the treatment, if the patient desires to move about, the joint should be supported by an elastic stockinette bandage, so applied as to support the ligaments tension upon which causes pain. When sitting or lying down no bandage is necessary, but the joint should be kept elevated. Attention to this latter point will frequently prevent the pain from returning at all. The treatment should be applied twice daily anyway, and oftener if return of pain demands it.

The application of liniments or any other after-treatment is uncalled for, and, although massage does no harm, I have never been able to convince myself that patients did any better under it, and have abandoned its use in this condition when hot air is obtainable.

In older cases the treatment is the same and the relief of pain just as prompt, but the repair is slower in proportion as the exudation and secondary changes in the tissues are extensive.

Adjunctive Measures.

When hot air is applied early, from three to five hours after the injury, any other measure will very rarely indeed require consideration at all. It is more rapidly curative and more effective in promoting the patient's comfort than any other measure now known. In older cases, however, where exudation has taken place, other measures in combination with hot are useful. The static wave current, static spark, massage, and alternating hot and cold douche, applied daily in alternation with the thermal agent, one in the morning and the other at night, are efficient in the order in which they are named. There is reason to believe that the static wave may prove ultimately to be the equal of hot air in the treatment of these injuries, both early and chronic. Further demonstrations are necessary before a conclusive verdict can be rendered on this point.

Although the results of hot-air applications to sprains appear magical at first sight, yet when the subject is considered from an analytical standpoint, it is seen that the agent produces its effects in the same way as does every other successful treatment of the condition, viz., through its action upon the circulatory and metabolic functions. The greater rapidity of repair obtainable and its greater effectiveness in relieving pain, are due merely to the greater profundity of its physiological action, and its general influence in these directions is beautifully exemplified by its effect in this condition.

The advantages exclusively dependent upon the use of hot air in sprains are as follows.

First, a rapidity of repair, exceeding that producible by any other agent now known, and by reason of which general systemic impairment due to lack of exercise from confinement to the bed, chair, or house, is never induced.

Second, immediate relief of pain, which can be rendered practically permanent by repeating the treatments as often as the pain becomes troublesome.

Third, entire absence of any but beneficial after-effects upon the organism at large, no matter how frequently the agent is applied.

CHAPTER VIII.

ARTHRITIS DEFORMANS.

The reason for placing arthritis deformans third in the list of diseases in the treatment of which hot air is important is not because of the rapidity or immediately apparent brilliance of its action in the affection, but because the agent is one of the two only measures that can be relied upon here to give anything like certain or even moderately satisfactory results. The other measure is static electricity. This disease has been hitherto, and is now, under other therapeutical measures, the despair of the medical profession.

It has always been my contention that if hot air did nothing but relieve the agonizing pain of acute rheumatism, it would be entitled to a place in the highest rank of therapeutical agents. We have seen that it not only does this, but that it lessens by a large percentage the duration of the disease, and transforms rheumatism from one of the most obstinate into one of the most tractable of ailments.

In arthritis deformans we are again struck by the claim which hot air imposes upon our respect, because of the power which it exhibits of rendering useful and comfortable many lives which would otherwise be spent in hopeless and helpless misery.

The correct diagnosis of this disease, from a therapeutical standpoint, is of the utmost importance, because it is one of those ailments in which the treatment of conditions closely resembling it clinically, is usually ineffective and sometimes positively harmful. Because of its importance, I shall touch

briefly upon some aspects of the problem that do not come strictly within the scope of this work.

Ætiology.

I think there can now be little question that the lesions observed in arthritis deformans are dependent upon impairment of the trophic functions of nerve trunks supplying the parts affected, or of the nerve centers in the sympathetic and spinal systems from which those nerve trunks take their origin. The most prominent reasons for this conception of its causation are that its constant lesions, viz.; dystrophy of the joint cartilages and articular portions of the bones, the pigmentation and textural changes in the skin, and the atrophy of the muscles controlling the affected joint, are all of a tropho-neurotic character; that it rarely, if ever, occurs in an individual who is not of a neurotic tendency, or debilitated by some illness, as la grippe, typhoid, nervous exhaustion, etc., or constitutionally weakened by some diathesis tuberculous, lithæmic, or otherwise; and that lesions, at least of the joints, identical with those encountered here are also met with in degenerative diseases of the spinal nerve tracts—as tabes, for instance. In cases of so-called “idiopathic” arthritis deformans that have come under my observation, I have never failed to find some one of these causative factors present, and I do not believe that the term “idiopathic,” as applied to this disease, will much longer stand the scrutiny of scientific observation.

It is not at all probable that the disease is “rheumatic” in its nature, although an acute attack of rheumatism in one whose nervous system is predisposed may precipitate the disease. I have had several such cases under observation. When such a case is encountered before the active rheumatic influence has

subsided, and if the trophic functions have not been too much impaired to recover upon removal of the exciting cause, anti-rheumatic treatment will frequently cure the arthritis deformans by removing the rheumatism which had set up the trouble. If the predisposition to the disease is constituted by the lithæmic or gouty diathesis as I believe it occasionally is, then iodide of potassium, colchicum, or other drugs of a like nature will always benefit and sometimes cure the affection. But when the disease is not dependent upon or precipitated by a pathological condition amenable to what we look upon as specific medication, nothing benefits it in the least except therapeusis directed toward improvement of the trophic nerve functions, and anti-rheumatic or anti-lithæmic remedies frequently cause an increase in the intensity of the symptoms. Local measures, exclusively, never accomplish anything but temporary relief of pain, while measures addressed to the nerve centers themselves accomplish a great deal in the way of permanent cure.

This is reasonably conclusive evidence that the disease is not primarily local. It is also improbable in the highest degree that local pathology of the nature encountered in arthritis deformans could produce, by any exaggeration of reflex phenomena, such profound trophic disturbances of muscles and skin as are constantly met with here. Further, the disease is always accompanied by marked evidences of irritability and debility of the spinal, and sometimes of the cerebral centers, for the explanation of which the presence of pain is not always sufficient.

These facts point most strongly to impairment of the trophic centers or the pathways conducting trophic impulses, as constituting the intrinsic and primary ætiological element. If this is true, then it follows that all nerve debilities—neurasthenia, hysteria, etc.—are not necessarily so devoid

of evil terminations as has been generally believed, and that thorough and efficient treatment of the same should be instituted as soon as they come under observation, and persevered in until they are removed. It is probable that when this plan of dealing with the so-called functional disturbances of the nervous system is generally adopted, we shall encounter arthritis deformans and some other grave diseases less frequently. I have had under observation several cases of what appeared to be simple nervous debility at first, in which slight arthritic symptoms developed. These were entirely done away with by treatment addressed to the original condition, and the occurrences strengthened considerably my belief in the nervous origin of the disease.

Diagnosis.

At the present time, unfortunately, this disease is more frequently overlooked and miscalled than probably any other to which flesh is heir. This is due to the fact that it has only very recently been recognized conclusively as a distinct disease entity, which has prevented the constant and characteristic symptoms from being studied and grouped so as to make it recognizable by physicians at large, and to the additional fact that it has hitherto been almost absolutely intractable to all known treatment, which has discouraged attempts to differentiate it because of the apparent uselessness of the result, if attained. The development of hot air and static electricity, however, has changed these conditions, and arthritis deformans can now be arrested and the affected joints restored to useful function in the vast majority of cases.

The signs which are constant accompaniments of the disease are a peculiar pigmentation and satiny dryness of the skin, pain, and nervous debility of variable intensity, which can

always be demonstrated as having preceded the attack. In addition to these, atrophy of the muscles controlling the joint and impairment of their function are usually, but not invariably, present. Tonic spasm of these muscles not infrequently accompanies the acute stage. For instance, I once had a patient under observation who developed a lockjaw from involvement of the maxillary articulation, which compelled me to feed him upon liquids only, through his teeth, for two weeks. More or less limitation of the masticatory movements is always present when this articulation is affected. Tonic muscular spasms sometimes become permanent contractures when the disease is not controlled, and ankylosis results.

The pigmentation of the skin occurs as maculæ, varying in size from that of the head of a pin to that of a quarter of a dollar, the smaller sizes predominating. They are irregular in outline, and resemble the freckles seen upon elderly people more than anything else. They differ from these, however, in possessing a characteristic yellowish brown, dirty look, which is usually distinguishable to an experienced observer, and also in that they are not confined to those parts of the body which are habitually exposed to the light, as is the case with true freckles. They usually are most in evidence on those portions of the skin contiguous to the affected joints, but may frequently be found also upon remote parts of the body, particularly the back, abdomen, extensor surfaces of the limbs, and the clavicular regions. I have never failed to find this peculiar pigmentation to some extent in every case of arthritis deformans that has come under my observation, and although it is frequently present in individuals who are not suffering from the disease, yet I have come to regard it, when taken in connection with other symptoms, as one of the most valuable of the differential signs.

The textural changes sometimes resemble the "glossy skin" seen in many cases of impairment of the function of peripheral nerves, and sometimes it does not exhibit any difference in color from that of the surrounding integument, but has a peculiar dry, smooth, soft look and feel, like satin.

Cases are sometimes met with in which the skin about the lesions looks greasy and is covered with a slight perspiration almost constantly, which condition is also encountered in other tropho-neuroses.

The pain is of two varieties: that in the joint itself ordinarily described by the patient as "boring" in character, and that in the nerve trunks from which the joint and its musculature are innervated. The first-mentioned is usually constantly present in the acute stage. At any stage it is increased by movement or by sharply bringing the affected articular surfaces together, as by tapping sharply and suddenly the bottom of the heel of the extended leg when investigating a hip. Palpation of the affected joint provokes pain, and the firmer the pressure the greater the pain induced. Occasionally a case is encountered, especially in old patients, where no pain of any sort is present while the affected member is at rest, but it is always provoked by motion.

The pain in the nerve trunks is paroxysmal, nearly always worse at night, and there is usually present in acute cases a constant, dull, aching soreness. Portions of the nerve are usually sensitive to pressure, as in common neuralgias.

A frequent cause of pain in cases where the larger joints are affected is spasm of the controlling musculature occurring during sleep. As soon as the patient relaxes into sound slumber he is awakened by excruciating pain, and finds the affected muscles strongly contracted. This condition is sometimes sufficiently persistent to prevent securing the necessary amount

of sleep, and the victim becomes so fearful of the agony of the awakening that he is afraid to attempt it.

A characteristic feature of the pain, when the hip joint is involved, is that it appears in the groin as well as in the hip. This peculiarity is very common in arthritis deformans, and very rare in most other affections of this joint from which it would have to be differentiated.

The nervous debility does not differ from that due to other causes, except in its profoundly trophic character. The tendon reflexes are somewhat increased usually; the secretions of the digestive ferment-producing glands are impaired, and departures from the normal, both gastric and intestinal, are in evidence. Sleeplessness sometimes from pain, but also sometimes from pure irritability of the cerebral centers, is occasionally a troublesome symptom. As a rule, however, patients nap sufficiently during the day to make up for what they lose during the night.

Atrophy of the muscles controlling the joint is a very constant phenomenon, and is usually accompanied by tenderness of the same upon pressure, as in pinching. Impairment of function is present in variable degree, which in many cases presents a characteristic also met with in rheumatism, viz., the muscles can be contracted up to a certain point, when further movements ceases as if the joint were hung on a ratchet. In other cases it consists of simple weakness, and in still others of a reflex inhibition of function from the pain in the joint which movement excites.

The elevation of temperature varies from half a degree to a degree and a half Fahrenheit, very rarely more, and presents a very constant general curve, being below normal in the morning, beginning to rise about eleven or twelve o'clock, and reaching its maximum in the early evening. In severe acute cases,

especially in young patients, it sometimes reaches 101° F., but I have never seen an uncomplicated case in which it went above that point. It will be observed that this resembles the temperature curve characteristic of some other diseases, notably tuberculosis, and it is not always the easiest thing in the world to differentiate arthritis deformans from joint tuberculosis at the first visit. As a rule, however, the temperature of tuberculosis runs higher than that of arthritis deformans, its curve is more irregular, and it reaches its maximum elevation earlier in the day. In doubtful cases the development of other characteristic signs will soon settle the question.

The urine of arthritis deformans very frequently contains a trace of albumin, probably due to renal irritation from excretion of products of faulty metabolism as it rapidly disappears under body hot-air treatments, but I have never observed casts in uncomplicated cases.

X-light is a very useful diagnostic agent in doubtful cases of some standing. By it can be demonstrated absence of cartilages which have been absorbed, a characteristic lesion of the disease when taken in connection with other symptoms and by reason of which the bony surfaces are closely approximated; a very different picture from that which obtains in healthy joints. Osteophytes, when present, are also observable by this means, and bony ankylosis is easily differentiated from the fibrous variety.

I have said nothing about the external appearances of the joints, because they do not possess any value as differential signs. One or more may be involved, the swelling may be diffuse or nodular, the skin over them may be shiny or dull, red, or devoid of any indication of inflammatory action.

We have simply a pathological joint, any of the appearances of which may be duplicated by several other affections, and when

these other affections enter the diagnostic problem it is invariably necessary to go outside of the external appearance of the joint for the decisive information. The same statement applies to the muscular contractures.

It will be observed from the above that the more prominent conditions from which arthritis deformans is to be differentiated are rheumatism, especially the chronic variety; chronic gouty and lithæmic conditions; neuritis; neuralgias; myositis; myalgias; tubercular, syphilitic, and traumatic joint lesions; and when symptoms are encountered pointing to the spinal column or hip joints as affected by a disease process, tumors in the thoracic or abdominal cavities, so situated as to involve the nerve trunks and plexuses in these regions. Lastly, various diseases of the peripheral nervous system. It is frequently only by a process of careful exclusion and the closest scrutiny of the history of the case that a correct diagnosis can be reached. It can be reached, however, positively, satisfactorily, and at once, in nine cases out of ten, and no pains should be spared to secure this end, in view of the fact that the disease is no longer to be classed with those that are not amenable to treatment.

I will close this brief section upon the exceedingly important problem of diagnosis by calling attention to the following additional facts which bear upon this point.

Although in the commonest form of the disease, which occurs almost exclusively in patients over forty, the small joints are first attacked, and the lesions nearly always are bilateral, yet this is not necessarily the case in all forms of the trouble. An attack may commence in the larger joints, run its course and recover without having involved the smaller joints at all; or it may be confined entirely to one large joint, as the hip, for instance. Some of the severest cases are of this character.

Involvement of the maxillary articulation is a very characteristic feature of this disease. It occurs with the utmost rarity in other diseases from which it might be necessary to differentiate it.

While the onset is usually gradual, with a beginning so insidious that the patient is not aware that anything is wrong until a wrench calls his attention to the sensitive member, yet it may develop as suddenly as acute articular rheumatism, and lay the patient helpless upon his bed in a night.

When the disease attacks a person under thirty years of age, it usually involves both large and small articulations, and in these cases the worst phases of the disease and those most resistant to treatment are encountered.

CHAPTER IX.

ARTHRITIS DEFORMANS—(*continued*).

Treatment.

Hot air alone will cure many cases of arthritis deformans, and so will static electricity, but as noted previously they are the only agents in the whole category of therapeutical measures of which this can be said. Here, as in most other situations, however, neither alone will do what it will when combined with other measures, and, in a disease which is so resistant to all therapeutics as is the one under consideration, it is incumbent upon us to use all the resources at our command. There are many cases that will not recover at all unless this is done, and in all the progress is greatly hastened by the combination. Under the very best of conditions recovery is a matter of months, but when we reflect that in the past we have been able to accomplish scarcely anything with any degree of certainty in any length of time, the possession of a measure which will restore to these victims useful joints and comfort in living is a matter upon which we may most sincerely congratulate ourselves, however long it takes to do it. The different elements of treatment will be considered separately, and lastly their most advantageous combination noted.

Hot Air.

The body treatment is the sheet anchor, because through it is secured the influence upon the trophic centers which constitutes the curative element. The temperature should usually not be less than 350° F., but will be governed by

circumstances. As atheromatous arteries are commonly met with in these patients, it may be necessary to give less heat during the first two or three treatments until the arteries have softened some; but 350° F. can be attained safely afterward. The guide is found in the circulatory phenomena. When the heart begins to labor unduly, which is indicated by a visibly quick, hard, strenuous throbbing of the cervical blood vessels, or when nausea, dizziness, or tension in the ear drums have been induced, it is time to stop. Irregularity of the pulse is also usually an indication that the treatment should come to an end, but this is not absolute, and depends upon the conditions surrounding the individual case. Sometimes the first treatment cannot last more than fifteen minutes, and the requisite rise in temperature and pulse cannot be attained, but as the arteries begin to regain their elasticity,—which they usually do in two or three treatments,—the response is more and more kindly, until finally the proper amount of influence upon the nerve centers can be induced.

The toes of patients with this disease seem particularly liable to suffer from the heat during treatment, I presume because of inefficiency in the blood circulation; hence it will frequently be necessary to place several layers of towels over these members to maintain comfort. Sometimes even this fails to secure comfort, and the toes must be uncovered and exposed to the air until the burning sensation has disappeared, when cool towels may be applied and treatment resumed. These maneuvers should be persistently repeated until the pulse and temperature indicate that the desired amount of central nervous influence has been secured. Efficient treatment of these cases will frequently take an hour, but the point of efficiency must be reached or the patient will not be benefited. The mere induction of perspiration, however profuse,

as has been stated in a previous page, does not mean that the treatment has been properly completed. The requisite rise in temperature and pulse rate does.

The local treatment does not constitute an important element in the management of this disease, and I have never seen it exercise any curative influence. As it is sometimes very efficient in relieving pain temporarily, however, it should always be tried when this phenomenon is troublesome. The technique does not differ from that applicable to rheumatism, except in that, as it is only useful as a pain-relieving agent, the temperature need be pushed only high enough to secure the analgetic effect—whether it is 200° F., or more.

Adjunctive Measures.

Static electricity.

The use of this agent has always been of marked benefit in arthritis deformans through its influence upon the general nutritional functions, but it was not until Snow developed the use of the Morton wave current in the treatment of the disease in 1899 that its full powers were revealed. Results are reported which rival those attained with hot air. Personally I have never had any experience with cases treated with static alone, but I always use it in connection with hot air, and can testify to its profound helpfulness. I give it at least once, and sometimes twice daily, in the form of the Morton wave current to the spine or joints affected, the breeze, and spark.

The wave current preferably, the breeze or brush discharge as second choice, produce good results in acutely inflamed joints, and give sedative effects in the majority of cases that are unequaled by any other measures. When the condition has progressed beyond this stage, the effect of long, thick,

single sparks is sometimes remarkable in reducing enlargements, restoring lost function, and inducing sedation, and is under all circumstances the most satisfactory treatment of the older lesions of this disease, with the sole exception of the wave current, which is sometimes here as elsewhere the remedy par excellence. Care must be exercised not to begin sparks too soon, or the inflammation in the joint will be aggravated thereby. Administer them cautiously at first, and watch the effect.

The static wave current over the solar plexus and abdomen will also usually give excellent results in the gastric and intestinal indigestions which are sometimes quite troublesome. When it fails, drugs are indicated.

Faradic.

This current plays very little part in the treatment of arthritis deformans when a static machine is available, but when it is not, a good high-tension coil is very useful as a temporary sedative. The current is passed directly through the aching joints, and the relative positions of the polarities is usually a matter of indifference. In the form of spinal and general faradization it exercises a very helpful influence upon the trophic centers and general metabolism. In rare cases it will be found that the coil gives sedative results in this disease superior to those produced by the static modalities or hot air.

Galvanic.

Galvanization of the brain and spinal cord, positive polarity, negative electrode over the solar plexus, twice weekly, is of marked service in combination with hot air and static. When treating the brain the usual great care must of course be exercised, beginning with the current at zero and increasing very gradually, diminishing the volume immediately if dizzi-

ness, faintness, or nausea occur. It is very easy to throw a patient into syncope during this operation. Usually 3 milliamperes for two minutes will be enough. In the cervical region the milliamperage may be increased to from 5 to 15, according to the patient's tolerance, watching carefully meanwhile for signs of phrenic or pneumogastric irritation, for three minutes. The dorsal and lumbar regions may be treated for from three to five minutes each, and, as no dangerous symptoms are to be feared in these vicinities, the current volume may be increased until the cutaneous sensibilities revolt, which means ordinarily from 20 to 30 milliamperes.

In treating muscles in a state of tonic contraction from irritation of the nerve trunks supplying them, as in the wry-neck frequently met with when the cervical vertebræ are involved, the positive pole of the galvanic battery, applied stable over the irritated nerve and the cord at the point whence it takes its origin, and labile over the contracted muscle, is very helpful. It mitigates the aching soreness considerably, and does a great deal toward relieving the spasm.

It has been stated that the soreness in the joints may be relieved by treating them with weak galvanic currents, positive polarity, using a hot-water bath in which the affected members are immersed as the active electrode. Although I have tried this repeatedly, I have never been able to convince myself that I perceived any more result from it than would be produced by the hot water alone without the current, and in acute cases I have occasionally seen the suffering increased. It is unquestionably greatly inferior to the static modalities, faradism, and hot air in this situation.

Drugs.

In administering drugs it should be borne strictly in mind that no medicine is admissible which will depress the

nervous system. It is only by maintaining the general trophic functions at their highest point of efficiency that we are able to control this disease at all. Medicines internally are indicated for two purposes—to mitigate the symptoms and to favorably influence the course of the primary disease process.

Among the most prominent symptoms which can be favorably influenced by drugs are gastric and intestinal indigestions, and constipation. For the first, bismuth subnitrate, charcoal, carminatives, and the digestive ferments may be used. For the second the various mineral waters, Veronica, Rubinat, Hunjadi, etc., or magnesium sulphate, are most efficacious. When they fail, a combination of aloin, strychnine, and belladonna will give excellent results.

Paroxysms of excessive pain in the affected joints and nerve distributions will sometimes yield very kindly to applications of Baume Analgesique (Bengue), but it will occasionally be necessary to resort to coal-tar derivatives. They should be given only in small doses and for a few hours at a time, and never until it has been demonstrated that hot air or electricity are inefficient in affording relief. Opium and morphine are never admissible, because of their unfavorable influence upon general metabolism. It is because the same property is inherent in the coal-tar derivatives, although to a less extent, that their use should be restricted as much as possible. It will fortunately not usually be found necessary to combat pain with drugs, as the physical measures ordinarily mitigate it to such an extent that it is bearable, and victims of this disease are so habituated to suffering that they endure a moderate amount without undue complaint.

The drugs which favorably influence the disease process *per se* are alterative tonics whose special sphere of action is the

central nervous system. The best of them are the chloride of gold and sodium, arsenic, strychnia sulphate,—which drug is not always admissible, as it sometimes increases the nervous symptoms,—iron, cod-liver oil, the tissue remedies, and lastly, and least frequently beneficial, the iodide of potassium.

The salicylates have something of a reputation in this disease, but I think without any foundation in fact, and the fallacy probably arose in the following manner. We occasionally have an attack of rheumatism, acute or subacute, engrafted upon a case of arthritis deformans, and of course the salicylates would be beneficial here. Enough care is not usually taken to make an analytical and differential diagnosis, and the benefit is set down as due to the influence of the salicylates over arthritis deformans. In the same way the disease is sometimes caused originally or increased subsequently by a gouty, lithæmic, or syphilitic taint, and here the iodides, if they had been administered, would get more credit than actually belonged to them. Again, it is conceivable that chronic malarial intoxication might be a causative factor, and then quinine would unquestionably benefit the patient. I mention this because it has been stated that quinine is of use in this disease. Personally I have never seen a case in which the element of malaria was traceable, and have never observed that any benefit followed the use of quinine.

As suggested by the above, any diathetic or acquired ætiological factors amenable to specific medication should be carefully sought for and treated by appropriate measures when present, but when the disease is not due to them,—and I do not believe that it is in the majority of cases,—the drug treatment confines itself within very narrow limits.

The therapeusis which has given me the most satisfaction as a routine combination is as follows. A body hot-air treatment three or four times weekly, the frequency governed by the

effect upon the patient; galvanization of the brain and spinal cord twice weekly; and static every day, in the form of the wave current, alternated on successive days with sparks to the spine in all cases and to the affected joints in appropriate cases. The drugs indicated are administered in conjunction with the physical measures, and the current from the high-tension coil for sedation whenever the pain becomes uncontrollable by the above-mentioned agents. This general plan is modified to suit the idiosyncrasies of individual cases.

Finally, in connection with treatment I will say that the ordinary form of the disease which begins in the small joints, and is markedly chronic in its course, usually yields fairly readily to treatment, even when it occurs in elderly people; but that form which involves the large articulations requires persistent and strenuous management in proportion as the debility of age is manifest. In a patient over seventy it yields very slowly.

In some cases the improvement under treatment in the general condition will be marked, but the local lesions will show no signs of permanent gain for several weeks. This is probably due to the fact that the local lesions are dependent upon trophic impairment of the central nervous system, and that they will not improve until these centers, which control their nutrition, have been brought to a state of efficient action. It is while this process is going on that they are at a standstill. Perseverance, however, will usually bring about the desired result, and this is another bit of evidence in favor of the conception of the primary ætiology of the local lesions herein stated.

Cases of arthritis deformans are very apt to relapse during the first year after recovery. The most common cause is an attack of some acute disease of a debilitating nature, as la

grippe. Another reason is that patients who have been accustomed to an active life before the disease disabled them are so elated and confident at being again in a condition to do something after months, and sometimes years, of enforced idleness, that they overwork. The overstrained nerve centers yield as they did before, and another outbreak obtains. It may appear in the same old joints, or entirely new ones may be invaded, and those affected previously escape altogether. The victims should be gotten under thorough treatment again as soon as possible, and this should be persevered in until recovery supervenes. Perseverance is a grand omniscient word in the treatment of this affection.

CHAPTER X.

ARTHRITIS DEFORMANS—(*concluded*).

Clinical Phenomena.

That form of the disease which affects the smaller joints is common enough and familiar enough not to require illustration, but the following case exemplifies very well the variety which involves the larger joints, as regards clinical characteristics and response to treatment.

Mrs. E. L. P., aged sixty-two years. Patient had noticed a soreness coming on after walking, just below the crest of the right ilium, four months previous to her consultation with me, which soreness had grown rapidly worse for two months, by which time it had extended so that it involved the front and inner aspects of the thigh as far down as the knee. It had continued to increase, until at the time of the consultation the pain was present in the hip, groin, and front and inner aspects of the thigh, and streaked down below the knee into the heel along the posterior aspect of the leg; her condition as regards pain and ability to move about was pitiable in the extreme. Was sleeping very poorly because of pain and muscular spasm in her thigh, which awakened her frequently during the night. Suffered frequently from hot flashes and formications irregularly distributed over the body. Appetite was fair and bowels regular.

She was markedly neurasthenic, and had been so since passing the climacteric twenty years previously. At this time she had also suffered quite severely from asthma,

but this had disappeared after a stay in another city, and had never returned. There was no history of injury. Mouth temperature had ranged from 97° F., in the morning, to 99.6° F., at night. The extensor muscles of the thigh on the affected side had been somewhat stiff and sore upon pressure for the preceding ten months, but she had not paid much attention to the matter until the acute and constant pain had drawn her attention to the development of the disability. Had been treated for rheumatism up to this time, but without beneficial result.

Her mother had died of consumption, and maternal grandfather was supposed to have died of it. She was one of a family of eleven brothers and sisters, seven of whom were dead, and their health histories and the causes of death were negative as far as indicating hereditary taint was concerned. Father had died of dysentery at the age of seventy-three years.

Physical examination showed that the arcus senilis was well developed and that her arteries were atheromatous, but the heart sounds did not exhibit any abnormality, and lungs were sound. There were no evidences of past or present disease in the small joints, and no tenderness was present. She was unable to cross the right leg over the left knee without lifting it with her hand, a very characteristic phenomenon when this disease attacks the hip joint. Patellar reflexes were slightly increased, especially on the affected side.

The characteristic pigmentation of the skin was present on the upper and outer aspects of the affected thigh and on the abdomen. Sensory phenomena in the skin covering the affected thigh and leg were normal. Passively moving the hip joint caused only a feeling of soreness, but smartly tapping the bottom of the right heel with the leg extended caused the patient to cry

out, and firmly pressing the head of the femur inward against the acetabulum, or tapping it smartly, produced the same result. The sciatic nerve was sensitive to pressure back of the trochanter, but nowhere else, and deep pressure in the groin just outside of Poupart's ligament elicited pain. Her urine contained a trace of albumin, but no casts.

It will be noticed that the characteristic signs of arthritis deformans of the hip joint were present, viz., inability to cross the affected limb over the opposite one unaided, while in a sitting position; pain in the hip reflected into the groin; pain upon pressing the head of the femur sharply and firmly against the acetabulum; the characteristic pigment spots in the skin, and the typical slight elevation of temperature with a regular course. The diagnosis lay between pelvic neoplasm involving the sacral plexus or its branches, which was ruled out by physical examination; sciatic neuritis, which was excluded by the absence of sensory disturbances in the distribution of the nerve, and the fact that stretching it by flexing the thigh upon the body did not produce pain until the hip joint began to be strained; and tuberculosis of the joint. The yellow spots, temperature curve, and intensity of the pain decided in favor of arthritis deformans, and I made this diagnosis.

She was admitted to the sanitarium for treatment May 15, 1900, four months after the acute trouble started. She was treated with the current from the high-tension coil through the joint that evening, with resulting marked remission of the pain, but she did not sleep well because of nervous irritability and muscular spasms in the affected thigh, which awakened her several times. The next day she was given a body hot-air treatment, which did away with the pain entirely while she was in the apparatus, but it returned sharply an hour afterward.

This was repeated every day the first week, and every other day, the second week. Local hot-air treatments failed to relieve the pain effectually, so they were abandoned and the current from the high-tension faradic coil, which performed this office better than anything else, was substituted at least once, and sometimes, twice, daily. During the night of May 18 she slept uninterruptedly all night, something she had not done before in many weeks, and she continued to sleep very well thereafter. The next day it was noticed that her limp was diminishing. On May 21 it was observed that the arteries at the wrist were growing softer and more elastic, and, to dispose of this matter for good, I will say here that when she was discharged at the end of three months I was unable to observe that any atheroma was left. Finally, in this connection I will state that a large number of cases of atheroma, at least in vessels susceptible of palpation, respond to body hot air in this manner. It is not usual for the condition to disappear so entirely, however.

At the end of two weeks she was so far improved that she would be free from pain for twenty-four hours at a stretch, and could walk a short distance without bringing on her limp. If she continued walking, however, it would provoke the old soreness.

I decided to transfer her to the list of out-patients, and she returned to the sanitarium for treatment three times weekly for the next two weeks, and twice weekly thereafter until August 3, when I discharged her cured. At this time she had suffered no pain of any description for two weeks. Her progress on the whole had been fairly steady, but there would be periods of two or three days at a time when her pains and disability would return upon her, as is usually the case with these patients. They rarely continue improving steadily from day to day, but have short periods of improvement followed by

periods of retrogression, but each period of improvement reaches a little higher level than its predecessor, until the trouble finally fades gradually and entirely away.

I next heard from this patient on February 18, 1901, when she called upon me one afternoon and said that she had felt none of the previous trouble, until about six weeks before, when she had suffered from a severe attack of la grippe. This had been followed by the old familiar pain, which was increasing in intensity, but not in the same place. It now involved the left hip and right elbow, and pigmentation of the skin was present in these regions and about the clavicles.

As the initiation of the process was so recent, and she was able to be about, I put her upon the out-patient list, and she came to the sanitarium for a body treatment, followed by some static modality, three times weekly for the next two months. The treatments were then reduced in frequency to once a week for two months more, when she was discharged cured. The drugs given were the chloride of gold and sodium, arsenic, strychnine, and occasionally a short course of bismuth subnitrate and peptenzyme for slight attacks of indigestion. I met her six months afterwards, and she told me that she had not only had no pain or other evidence of her old trouble since her last visit to the sanitarium, but that she had never felt better in her life than she had since then.

This case is instructive in several ways. First, it is an example of pure, uncomplicated arthritis deformans, and exhibits a beautifully typical symptom complex of the affection when it occurs in the hip joint; second, it shows the futility of anti-rheumatic treatment in pure cases of the disease; third, it illustrates during the first attack the power of body hot air alone in controlling the disease, as the faradism used acted only, and was intended only, as a sedative; fourth, it exemplifies

the power of the body hot-air treatment in lessening, and sometimes apparently removing entirely, atheroma of the arterial system; fifth, it is an example of the influence of acute infectious disease in precipitating a relapse; and sixth, it exhibits the influence of the current from the high-tension coil in temporarily alleviating the pains of the disease when other means are inefficient. Usually static is effective for this purpose, but, as has been previously stated, faradism or the high-frequency current gives better results in rare cases.

It is generally believed that bony ankylosis never occurs in arthritis deformans, but I have seen one case which leads me to think that it sometimes does. The patient came under my care for an acute attack of the disease in his shoulders, wrists, fingers, knees, and ankles. Twelve years before, when eighteen years old, he had been confined to his bed for several months by the same trouble in his hips and toes, from which he had recovered. At the time he came under my charge his toe joints presented the characteristic deformities much exaggerated, and the pathology of the lesions was verified later, when he had the little toe of each foot amputated at the metatarso-phalangeal articulation, because they interfered with the wearing of shoes. The point of greatest interest in this connection, however, lies in the fact that both of his hips had been completely ankylosed by the first attack. It is conceivable that the ankylosis might have been due to exaggerated osteophytic outgrowths rather than true bony ankylosis, but it is hardly probable that such a phenomenon would have appeared in both hips during the same attack of the disease, and highly improbable that it would have reached the degree of complete ankylosis under these conditions. X-ray examination, as far as it went, also indicated bony ankylosis. This joint in adults, however, is not often as sus-

ceptible of satisfactory and conclusive diagnostic demonstration through the medium of X-rays as some others in the body, and it is frequently very safe to interpret the findings with the traditional grain of salt. This is the only case of the sort that I have ever seen. In this patient the disease was completely extinguished from those joints which were acutely involved when he came to me, in eight months, but of course no change took place in the original seats of the process.

The advantages exclusively dependent upon the use of hot air in the treatment of this affection are as follows.

Its profound influence upon metabolism increases the oxidation of waste material, and hence excretion through the skin, lungs, and kidneys, thereby relieving the already depressed nervous functions from the further depression which would be induced by its retention in the body.

Its power of temporarily mitigating pain and its sedative action upon the nervous system increases greatly the amount of sleep procurable, which still further invigorates the nerve centers.

Its reflex action upon the nervous system as a whole is in the line of a stimulant to physiological repair and normal function; hence its judicious, intelligent use is not followed by any evil reactionary effects.

Finally, by its aid we are enabled to restore to usefulness and comfort a very large proportion of the victims of this disease, who without it would be irrevocably doomed to a painful life of hopeless and helpless crippledom.

CHAPTER XI.

NEPHRITIS.

By this term is meant true Bright's disease and not the infectious inflammations of the kidneys. The ætiology of both the acute and the chronic forms is a subject as yet open to discussion, but the belief seems to be steadily growing that the renal pathology observed is due to the excretion by the kidneys of substances irritant to their functional structures which are abnormally present in the blood. The presence of these bodies in the circulation is probably due to imperfect metabolism somewhere in the economy by reason of which oxidation is incomplete; a condition, in short, somewhat similar primarily to that which constitutes the gouty diathesis. If this proves to be true, the disease will have to be transferred from the category of the renal to that of the constitutional disorders; an impairment of general metabolism, of which the changes in the kidneys are but secondary local manifestations.

The manner in which the disease responds to hot-air applications strengthens this conception of its causation, as does also the fact that the only therapeusis that has ever been of value in the condition is that which has had elimination of some sort, or increase of oxidation in the body as its object. The clinical aspects of the disease are also indicative of systemic toxæmia of some sort. What constitutes the toxic agency we have yet to ascertain, but it is now pretty thoroughly established that it is not urea;

probably some antecedent bodies. The effect of body hot-air treatments in all sorts of diseases is to increase the excretion of urea from fifteen to sixty per cent., according to determinations made in my laboratory, the higher percentages coming almost without exception from the uræmic cases. This would indicate that its beneficial influence in this disease is due to a power by reason of which these antecedent bodies are oxidized into a form susceptible of normal and unirritating excretion.

When I first began to use hot air in 1898 I was supplied only with the local apparatus, but one of my early experiments was upon a case of chronic Bright's disease. I applied the agent locally over the kidneys in this and shortly after in a second case, but with entire failure as far as beneficial results were concerned, in both instances. My next experience with the agent in this condition was accidental, and after I had been using the body apparatus for some months. A patient who had had chronic nephritis for many years was being treated for rheumatism. It was noticed after two or three days that the albumin in her urine was lessening, and about two weeks after her first body treatment it had entirely disappeared. It had not returned three months afterward, and during this period the patient felt perfectly well in every respect and exhibited absolutely no evidences of renal impairment. At the end of this time she removed to another city and I have not seen or heard of her since, hence do not know if the result was permanent in her case. This occurred in the spring of 1900.

As has been stated, body hot-air treatments rapidly lessen the quantity of albumin sometimes encountered in the urine of arthritis deformans, and the above incident, in connection with my observation of this fact, induced me to subject my

renal cases to the influence of this element of therapeusis. The results were most gratifying.

As a rule asthma, œdema, nausea, headache, somnolence, etc., promptly disappear. The urine becomes sometimes entirely free from albumin and the quantity of this abnormal constituent is always markedly lessened. The patient is usually restored to usefulness and sometimes to apparently perfect health. The question of permanency is one which cannot as yet of course be passed upon as the cases have not been under observation long enough, but the transcendent value of body hot-air treatments, in relieving to a great extent the symptoms of renal insufficiency, has been established beyond cavil, and it now only remains to ascertain how long the relief will last. This may prove to be a point of comparatively minor importance, as recurrences so far seem to yield to treatment as readily as the original attack, and repeated recurrences merely mean that the patient must take repeated courses of treatment. If the intervals between the courses were not unreasonably short, any victim of chronic Bright's disease would be only too glad to get out of his difficulty as easily as this.

I have not yet treated, and have not heard of anyone else having treated, a case of complete uræmic coma with hot air. It is reasonable to suppose, however, that it would act as efficiently in this condition as in the milder forms of intoxication, and if this proves to be true it will have forged another great claim upon our respect.

Treatment.

The local application of hot air never enters into the problem at all, and the technique of the body treatment is very simple. The majority of these cases are encoun-

tered in persons whose arteries have not yet taken on atheromatous changes, hence particular care in this direction is not necessary. There is usually present, however, a high pulse tension, and during the first treatment the heat should be increased very slowly, watching this phenomenon meanwhile. It usually disappears during or immediately after the first séance. If no undue exhaustion follows the first treatment, and it very rarely does, the application may be repeated the following day, and thereafter every second or third day until the albuminuria and other symptoms have disappeared. The temperature of the first treatment should be at least 300° F. unless contra-indications obtain, and in those succeeding it may be pushed to 350° F., and run up as quickly as the patient's tolerance will permit. By this modification we secure a sudden strong impulse upon the nerve centers, which it is our aim to influence as profoundly as possible. The after-care of the patient is that usual to the body treatment.

The respiratory embarrassment, cardiac disturbances, œdema, headache, high pulse tension, and mental sluggishness are nearly always markedly relieved by the first treatment, sometimes before the patient leaves the apparatus, and it is not unusual to see them disappear entirely within four hours.

Adjunctive Measures.

Diet.

The diet should always be cut down to milk and milk only, if possible, until the toxæmia has been gotten thoroughly under control, and should then be regulated as is usual in these cases. The more water the patient drinks the better, and it will not increase the dropsy under these conditions, as is sometimes supposed.

Electricity.

Static electricity in the form of the Morton wave current to the spine is valuable as a general tonic, and may be given in conjunction with hot air once or twice daily for twenty or thirty minutes. It is credited by some observers with extremely good results in this disease when used alone, but I have never relied upon it to the exclusion of hot air.

Drugs.

The bowels should be kept freely open by the use of calomel and salines when any inclination towards constipation is evident, and digestive disturbances should be corrected, but aside from this, drugs are very rarely necessary when hot air is being administered, and the less medicine the patient ingests the better usually.

R. W. Corwin in the *Denver Medical Times* for June, 1901, reports one case of Bright's disease with partial paralysis of the right leg following uræmia, in which the uræmic symptoms disappeared "quickly, after three baths had been given, and the patient recovered full use of paralyzed muscles," and an acute case following variola, with great œdema of the subcutaneous tissues and fluid in the abdominal and pleural cavities, which recovered completely in less than four weeks. These are the only cases, aside from my own, that I have seen reported.

The advantages exclusively dependent upon the use of hot air in the treatment of this disease are as follows.

First, rapid relief of the dropsy, respiratory and cardiac embarrassment, frequently within four hours.

Second, the accomplishment of this result without the aid of, and more efficiently than is possible with, drugs; hence

avoidance of the deleterious after-effects not infrequently induced by the latter.

Third, the marked lessening of the general toxæmia and of the quantity of albumin in the urine, together with the increase in the quantity of urea excreted, affords ground for the belief that a certain amount of correction of the faulty metabolism, which it is probable constitutes the main ætiological factor in the production of the clinical phenomena of the disease, is also effected by body hot-air treatments. For a decisive verdict upon this point, however, it will be necessary to wait a little longer, and observe whether or not, and how, exacerbations after treatment enter the problem in the future.

CHAPTER XII.

LOCAL SEPTIC INFECTION.

This is a condition which is pregnant with danger to the victim, and the ordinary methods of management leave much to be desired in the way of results. The ætiological factor here is the invasion of the tissues by pathogenic germs, which produce somewhere during the cycle of their existence poisonous substances—ptomaines—which are absorbed into the circulation and exercise a most viciously depressing influence upon the vital nerve centers. Nature's chief weapon for resisting this invasion consists of the process known as leucocytosis, whereby the infectious focus is walled off from the rest of the body by the formation of inflammatory tissue. It is also probable that some at least of the noxious micro-organisms are directly destroyed by the white blood cells.

When the body temperature is raised hyperleucocytosis obtains. Friedlaender has found that the increase amounts to twenty-five per cent. sometimes, with moist hot-air treatments which raised the body temperature from 2° to 3° F., and this becomes even greater when the medium surrounding the patient is dry, whereby the evaporation of the sweat is facilitated instead of impeded. Dry hot-air body treatments thus give us the assistance of nature's most effective means of resisting microbic invasion.

Another very powerful help furnished by dry heat of sufficient intensity is the profuse perspiration induced. This secretion carries out with it a certain proportion of the toxins present, and the nerve centers are thus relieved from the amount

of depression represented by the amount of toxin so excreted. The stimulation of the processes of oxidation throughout the body dependent upon the treatment calls to our assistance also the lungs and kidneys, and the irritation of the nerve endings in the skin arouses the whole nervous system to renewed vigor of function. We thus secure not only a most active resistance to further invasion, but at the same time a most active elimination of the noxious products of the invasion that has already taken place.

Finally, in the case of the local treatments at least, we secure an inhibitory influence upon germ growth by raising the temperature of the invading micro-organisms and their pabulum at the primary focus of infection, whereby the virulence and profundity of the general toxæmia are diminished.

The writer's first experience with hot air in the treatment of well-marked local septic infection was on September 11, 1900. A patient was admitted to the sanitarium on that date who had developed a septic process from a cut on the little finger of her left hand two days previously. She had suffered intense pain for thirty-six hours, temperature had reached 103.5° F., pulse 112, and marked prostration was present. The hand and wrist had become involved, and red streaks followed the lymphatics up the arm nearly to the elbow. A local hot-air treatment was administered in the hope of relieving the pain, which it accomplished in forty-five minutes, and the patient slept for the first time in twenty-four hours. That evening, to my intense surprise and gratification, the patient's temperature had dropped to 99.2° F., the pulse to 60, and the pain had not returned to any great degree.

By the next morning the swelling and redness had nearly disappeared, but the temperature had risen to 101.4° F., the

pulse to 84, and the pain was considerable again. She was given a body hot-air treatment. The pain in the affected hand and arm was relieved during this procedure and did not return again sufficiently to demand another local treatment, and, to make a long story short, the affected members progressed to a complete and fairly steady recovery during the next four days, at which time the temperature reached the normal point and stayed there.

Since then the writer has treated all of his septic cases with this agent and with the same satisfactory results, except that the relief of pain has not always been as prompt and lasting, and in the severer cases, of course, the time required for complete recovery has been longer, sometimes as much as three weeks. This latter, however, amounts to very little when we consider the small chance of recovery in any length of time which the victim of ordinarily severe blood poisoning has under other methods of treatment.

Treatment.

Hot Air.

When the case comes under observation while the process is still confined to a limb, local treatments of the limb are usually sufficient to effect a cure. The technique does not differ from that usual to the local treatment, and the temperature should be run up to 300° F. or 350° F., according to the tolerance of the patient.

If the septic process has invaded the lymphatic glands of the joint that connects the limb with the trunk, if much general toxæmia is present, or if the patient does not respond at once to the local application, the body treatment should be used. The technique is that usual to this treatment, except that we cannot use the temperature of the patient as a guide to the

duration and intensity of the application, because it is usually considerably elevated when the patient is placed in the apparatus. The pulse also is not entirely reliable as a guide. We have to be governed more by the effect upon the organism as a whole, and the instinct which is the result of experience is most valuable in this connection. In general, however, it may be said that the treatment should last not less than twenty minutes, and the temperature required will vary from 250° F. to 350° F. The response on the part of each individual patient at each séance will govern both intensity of the heat and duration of the application. As a rule it will not be wise to push the pulse above 140 beats per minute, and the symptoms noted under "Technique of the Body Treatment," as indicating excessive stimulation, should be carefully avoided.

A point deserving of consideration in treating these cases is that when a patient has been severely septic for several days, as many have been before they are given the benefit of hot air, his nervous system exhibits the irritability of depression to a marked degree, and he is not able to endure the body treatment for half an hour. Under these circumstances the heat should be run up quickly, for instance to 300° F. in fifteen minutes. By this means a quick and effective stimulation may be induced before the patient's endurance is exhausted, whereas, if the temperature ran up as slowly as would ordinarily be the case, it would not be possible to secure the necessary deep reflex response without forcing the length of the treatment beyond a judicious limit.

It is not necessary to protect operation wounds with more wrappings than the rest of the body, and the proper surgical dressing will ordinarily be sufficient. The healing of the wounds is greatly hastened by the treatments.

*Adjunctive Measures.***Electricity.**

Electricity never enters the therapeutical problem when hot air is available, except to assist in healing sluggish sinuses after operative interference. Here the negative pole of the galvanic battery applied to the offending granulations through a bare metal electrode, using from three to five milliamperes of current, will do more execution than any other measure with which I am familiar. Care should be taken not to use enough current to cauterize. The good results are effected by electrolysis, not by cautery.

Operative interference will be necessary when glands or other structures have been disintegrated beyond the possibility of recovery and suppuration becomes inevitable. Hot air must not be expected to remove pus. Its great functions in suppurative cases are to relieve pain, prevent the infection from spreading to contiguous structures, lessen the systemic toxæmia, and hasten the repair of damaged tissues. These it accomplishes nobly and well.

Drugs.

Drugs are useful to keep the bowels open and to correct digestive derangements, magnesium sulphate for the former and digestive ferments with small doses of strychnia for the latter. It is very rarely indeed necessary to give them to relieve pain or for stimulation, after the administration of hot air is begun. The management of the diet does not differ in any particular from that ordinarily indicated in this condition.

The advantages exclusively dependent upon the use of hot air in local sepsis are as follows.

First, Rapid relief of pain.

Second, the induction of hyperleucocytosis, whereby the in-

fective process is frequently abruptly arrested, and nearly always prevented from spreading from structure to structure.

Third, relief of the nerve centers to a large extent from toxin depression, because of the increase in the process of elimination.

Fourth, the avoidance of reaction from drug stimulation, because an amount of depression sufficient to demand the same does not ordinarily obtain after the administration of hot air has been commenced.

CHAPTER XIII.

PNEUMONIA.

The writer was first led to use hot air in pneumonia by his observation of its kindly influence upon peritonitis. The first case of pneumonia so treated, and also the case of peritonitis which gave rise to this impression, are reported in the New York Medical Journal for December 2, 1899. It was applied to the pneumonia more in the hope of relieving the pleuritic pain than of influencing the pneumonic process, but to the writer's intense surprise and gratification the general and local symptoms were mitigated as well as the pleurisy, and in subsequent cases the agent has confirmed its claims to respect then put forward, as a therapeutical measure with which to attack this affection. At the present time the writer believes that judiciously and thoroughly applied hot-air treatments constitute one of the most efficient means now known for combating this disease. A glance at the pathology of the disease is necessary in order that the rationale of the influence of hot air may be comprehended, and the conception of the same put forward by Dr. Andrew H. Smith of New York City carries with it more conviction than any other of which I am cognizant. In addition it explains very satisfactorily the action of hot air in this situation. Briefly, it is as follows.

The primary pathological element consists of the existence of cultures of pneumococci in the pulmonary alveoli, from which toxins are absorbed into the circulation and produce the general systemic disturbance. The pabulum for the growth

of the micro-organisms is constituted by the fibrinous exudate which pours into the alveoli because of irritation of their walls by the presence of the germ colonies. That it is not an inflammation of lung tissue in the ordinary sense is indicated by the fact that any such inflammatory process of a sufficient intensity to produce the clinical phenomena of pneumonia would very surely be followed by irreparable destruction of large masses of pulmonary tissue, whereas in this disease, after the process has subsided, the integrity of the lung structure is usually entirely restored; and because autopsical findings demonstrate that the bronchial or nutrient circulation is very rarely involved at all, but that, when it is, gangrene of the areas strangulated is very sure to result. This means that obstruction of the pulmonary or functional circulation by the exudate, together probably with reflex pneumogastric irritation due to the same cause, is responsible for all of the respiratory, and much if not the greater part of the cardiac disturbance observed in uncomplicated pneumonia.

The life of the pneumococcus in artificial cultures is from ten to twelve days, and it is one of the most sensitive of all bacteria to changes in the condition of its pabulum as regards temperature, reaction, etc. It grows best in faintly alkaline media, and a marked acidity will entirely inhibit its development, hence the fibrinous exudate in the air-cells constitutes an ideal culture medium. During the process of hepatization pneumic acid forms, and when the saturation of the exudate reaches a sufficiently high point the further development of new colonies of germs is thereby inhibited. It is by reason of this fact, together with the exhaustion of the culture medium (exuded fibrin) and the possible formation at a certain stage of an antitoxin, that the termination by crisis obtains. Modifications

of these conditions produce termination by lysis. Professor Smith presented the subject in detail in an address to the New York Academy of Medicine, which was published in the Medical News for December 16, 1899. During the course of this address he states his "Views as to the sequence of events taking place in an attack of pneumonia," as follows.

"1. The occurrence of some cause of depression, either local or general, which favors the germination of pneumococci, already present in some one of the smaller tubes.

"2. The formation of a colony that spreads until it reaches the group of air-vessels that are terminal to the tube in question.

"3. The setting up of an irritation in these vesicles, causing a fibrinous exudation, an emigration of leucocytes, and a diapedesis of red cells from the functional capillaries.

"4. The formation of a colony of pneumococci in the medium afforded by this exudate.

"5. Arrest of the blood stream in the functional capillaries, followed by accumulation of free pneumonic acid in the parenchyma of the affected area.

"6. Overflow of exudate into neighboring lobules, starting the process in them also.

"7. Arrest of germ growth by the exhaustion of the medium and the accumulation of free acid in the tissue of the lung. Up to this time there has been a constant formation and absorption of toxin.

"8. Retrogressive changes in the exudate preparatory to its removal by absorption.

"9. Probably, in this latter process, formation of an anti-toxin principle.

"10. Entire removal of the exudate and restoration of the vesicle to its normal condition.

“11. Resumption of the functional capillary circulation.”

We will first consider the clinical results of hot-air applications in pneumonia and then the logic of their administration as indicated by the pathology of the disease, and the following case affords a very good illustration of its constant effects.

Mr. G. W. P., clergyman, aged thirty-four years. I saw the patient first on March 29, 1900, at 9 A. M. He had been in his usual health until the preceding evening, when he had begun to feel “badly all over,” and had noticed a sharp pain under his left nipple. This had grown worse during the night and towards morning he had begun to cough some, which increased the pain, as did also deep respiration. Auscultation and percussion elicited nothing abnormal. His pulse was 76 per minute, respiration 20, temperature 98.6° F. It looked like developing influenza, and the patient was sent to bed and an anodyne cough mixture prescribed.

March 29, 7 P. M. The cough had increased during the day and the pain under the nipple was now harassing in the extreme. Severe headache had developed, but there was no expectoration. Pulse was 100 per minute, respiration 48, temperature 101.6° F. Physical examination discovered a few crepitant râles and a marked pleural creak, but no dullness. I made a diagnosis of commencing pneumonia, directed that a hot-water bag be applied over the site of the pleurisy, and that five grains of antikamnia be given every hour until the headache was relieved.

March 29, 11 P. M. The pain had lessened somewhat under the influence of the hot-water bag and ten grains of antikamnia, and this drug was now discontinued. Slight dullness had developed over the lower lobe of the left lung. Pulse was 98, respiration 48, temperature 100.6° F.

March 30, 8 A. M. Patient had been very restless during

the night and had slept but little. Headache and pleuritic pain had increased after midnight and were now again extremely harassing. He was expectorating a green viscid mucus, which adhered to the bottom of an inverted dish. Pulse was 100, respiration 42, temperature 100.8° F. Dullness was now marked over lower lobe of left lung.

Patient was greatly prostrated, and his pain, frequently exacerbated by coughing, was increasing his prostration, but I hesitated to give him morphine because he was of a markedly neurotic temperament, and I also feared the respiratory depression so frequently dependent upon its administration under these conditions. I decided to try Baume Analgesique applied over the pleurisy with a hot-water bag over it, and directed that I be notified if no amelioration occurred by eleven o'clock.

I was so notified, and decided to treat the consolidated lobe with dry hot air, which was done at noon. At the end of the treatment the pleuritic pain was entirely relieved except when coughing violently or upon forced respiration, and the pulse had dropped to 96, respiration to 28. During the morning the sputum had become blood-stained and was now typically pneumonic.

March 30, 8 P. M. The pleuritic pain had remained in abeyance until 6 P. M., but had been very severe since. Pulse was 100, respiration 50, temperature 103° F. Hot air was again administered, completely relieving the pain as usual, and at the end of the treatment the pulse was 94, respiration 38. I left the patient resting quietly.

March 31, 9 A. M. He had continued to rest comfortably until 2 A. M., when the pleuritic pain had begun to return and it was now severe again. The cough had greatly lessened and what little sputum he raised was rusty and very tenacious. Pulse was 96, respiration 32, temperature 102.2° F. The dull-

ness over the affected lobe was markedly less and numerous coarse râles were present. Hot air was again administered.

March 31, 9 P. M. Patient had no pleuritic pain during the day, but at 8 P. M. it had returned nearly as severely as before. Sputum had become much lighter in color during the afternoon and was much less tenacious. Percussion betrayed only a very small area of slight dullness over the affected lobe, and the coarse râles so plentiful in the morning were disappearing. Pulse was 100, respiration 30 but had dropped to 28 at noon, and temperature 102.2° F. Hot air was administered.

About fifteen minutes after treatment was begun the pleuritic pain disappeared, and the patient remarked how good it seemed to be free from it. Shortly afterward he exclaimed, "Oh, how queer I feel!" I asked him what the matter was, and he tried to speak but could not answer. His eyes closed, muscles relaxed, and he appeared to have fainted. I felt the pulse; it was very soft and the respiration as well as the pulse had become very slow. His lips were blue and the skin of the face was ashen. I immediately removed the apparatus, threw the clothing from his body and had the nurse fan him vigorously, while I opened a window and got a hypodermic of strychnia ready. It was not needed, however, as in a minute or two he revived, opened his eyes, and his pulse and respiration resumed their former rate and character. He said he had lost consciousness and felt that his death was imminent. I shall refer to this incident again when describing the technique of the treatment.

By evening of the next day, April 1, the physical signs of consolidation had entirely disappeared, but râles were still present, and they persisted in some degree in this situation for about a week. From this time until April 4 the only noteworthy event was an acute œdema of the lungs, lasting about

six hours, which occurred in the morning of April 2. For thirty-six hours previously the patient had suffered from a headache which had utterly resisted the ordinary analgetics, and which had become so severe that I was obliged to resort to morphine hypodermically during the night of April 1. The cedema yielded to hypodermics of strychnia and atropin in about five hours.

Shortly after midnight of April 3 the patient became slightly delirious, and about three o'clock in the morning of April 4 pleuritic pain appeared over the lower lobe of the right lung. I saw him at 8 A. M., at which time his pulse was 104, respiration 38, temperature 102.4° F. The original focus of infection in the lower lobe of the left lung was in a satisfactory condition, but dullness had appeared over the lower lobe of the right lung. I called again at noon and found that the dullness which was present in this situation in the morning had increased to flatness, and the sputum was rusty. The general condition was about the same as in the morning. Hot air was applied over the lower lobe of the right lung.

April 4, 10 P. M. Patient had passed a very comfortable afternoon. Sputum was still rusty. Pulse 106, respiration 36, temperature 101.6° F. The flatness over the lower lobe of the right lung had decreased to dullness, and hot air was administered again in this situation. As the patient was excessively prostrated, I remained with him during the night.

April 5, 8 A. M. Patient had developed a severe lumbar myositis in both sides, but especially marked in the right, which had first manifested itself about 4 A. M. Spasms in the affected muscles were frequent and painful and extreme tenderness to the touch was present. I directed that mustard pastes be applied over the affected structures.

April 5, 10 P. M. Muscular spasm and pain had been only

slightly relieved by the sinapism and the patient had suffered considerably from them during the day. The slightest movement on his part or manipulation by anyone else would set up the spasm. Pulse was 94, respiration 34, temperature 100.2° F., and general condition much the same as in the morning. Physical examination demonstrated that dullness was present only in spots over the lower lobe of the right lung, and that air was entering pretty freely nearly every part of it. Hot air was administered again and the cloth attachment was carried downward and backward so as to include the inflamed muscles. At the end of the treatment the patient could cough, respire deeply, and move about in the bed, and the parts could be manipulated without causing spasm or pain. The patient's continued extreme prostration decided me to remain again by his bedside during the night.

April 6, 8 A. M. Patient had passed a very comfortable night, sleeping most of the time. Had suffered slightly from muscular spasm about 2 A. M., but at this time only very slight soreness upon manipulation was apparent, and patient could move freely without exciting any spasm or pain. Sputum had lost its rusty character and was whitish and somewhat frothy. Pulse 92, respiration 28, temperature 99.2° F. Dullness had disappeared entirely from the lobe last affected, but some râles were still present in this and also in the lower left lobe.

From this time on the patient's recovery was steady and uneventful, except for a short but pretty sharp return of the myositis on April 8, which was readily controlled by hot air. The temperature returned permanently to the normal on April 22, with a pulse of 78 and respiration of 18, but it had not been higher than 99.2° F. after April 4. The extreme prostration which had caused me so much anxiety on April 5

and 6 disappeared rapidly after April 8, and the convalescence was entirely satisfactory in every respect.

It will be observed that in this case the administration of hot air was followed by the results noted below.

First, immediate relief of the pleuritic pain, which relief lasted for several hours after each treatment.

Second, a decrease in the frequency of respiration, probably due to relief of the pleuritic pain, and which on the evening of March 30 amounted to twelve cycles per minute.

Third, lessening of the cough.

Fourth, a drop in the temperature amounting to from half a degree to one degree. It will also be observed that after the second treatment the temperature did not at any time rise above 102.2° F. until the morning of April 4, when the right lung became involved, and even then it only reached 102.4° F., an unusually low temperature for a severe case of pneumonia.

Fifth, entire disappearance of the physical signs of consolidation within forty-eight hours after the first treatment was administered.

Sixth, immediate relief of the pain and spasm from the myositis on the evening of April 5, and rapid resolution of the same.

These phenomena usually follow the local application of hot air in this disease and in just this way, except that the lessening of the cough and frequency of respiration is not so marked or immediate in cases where the increase in these symptoms is due to causes other than pleuritic pain, and the entire disappearance of the physical signs of consolidation sometimes requires three or four days instead of forty-eight hours. The lessening of these signs, however, almost always becomes apparent within twelve hours after the first treatment.

Two other features in the clinical behavior of the disease

when treated by this agent are noteworthy in this connection, viz., if the treatments are discontinued as soon as the physical signs of consolidation have cleared up, these signs will usually reappear in some degree, accompanied by some increase in the temperature and general symptoms after twenty-four hours, and even when the treatments are persisted in, general systemic disturbance, evidenced by some persistent increase in the body temperature, acceleration of the pulse and respiration, and general prostration, will be apparent until the disease reaches the period of normal defervescence. This indicates that local hot-air treatments do not entirely arrest and put an end to the pathological process, but only very markedly ameliorate the condition. We are able to secure a lessening of the strain upon the nervous system, and the rapid removal of the exudate does away with danger to the right heart.

CHAPTER XIV.

PNEUMONIA—(*continued*).

Principles of Action and Technique.

To comprehend the rationale of the action of hot air in pneumonia the following features of the ætiology and pathology of the disease must be borne in mind.

First, the diplococcus of Fraenkel is an organism exquisitely sensitive to changes in the temperature and character of its pabulum, and its life period is from ten to twelve days.

Second, we have a condition here which is closely analogous to that which obtains when cultures of the organism are grown in the laboratory; the walls of the pulmonary alveoli acting as test-tubes, to use another of Professor Smith's apt illustrations, and the exuded fibrin as culture medium.

Third, when consolidation has taken place, the layers of the pleuræ being in apposition, and even sometimes absolutely adherent from fibrin exudation, we have practically a solid tissue from the integument to the inner limit of the consolidation, except in those comparatively infrequent cases where the consolidation is central exclusively.

Fourth, the general systemic phenomena are due to the influence upon the various nerve centers of toxins emanating from the germ cultures in the alveoli and absorbed into the blood.

Fifth, the most virulent toxins are produced where the colonies are youngest, hence come from the periphery of the affected area, where the cultures are thinnest, and spreading into other alveoli.

Sixth, it is probable that in many cases much of the cough and a considerable proportion of the respiratory acceleration are due to reflex irritation, set up by the pleurisy which usually accompanies the trouble.

Seventh, death is directly due either to paralysis of nerve centers from toxin absorption, or paralysis of the right heart from over-distention dependent upon massive exudate.

Now, when a hot-air treatment is administered over a consolidated lobe, the heat can be made to penetrate in some degree nearly, if not quite, through the whole of the affected area by conduction, as the part is then practically a solid tissue. By this means the temperature of the pabulum of the invading micro-organisms is raised and one of the most essential conditions of their well-being disturbed. We have seen that it is only in the absence of a disturbance of these conditions that the germ is able to grow at all, hence we are able to secure an inhibitory influence upon its development, consequently a lessening of the quantity and virulence of the toxins formed. As the general symptoms are due to absorption of these same toxins, an influence which lessens their quantity or virulence will also lessen the general symptoms, hence we get a drop in the temperature and a considerable amelioration of the depression of the nerve centers.

Relief of the pleuritic pain leads to disappearance of that proportion of the cough and respiratory acceleration dependent thereon, and the absorbents are stimulated by the heat to a high degree of activity, which leads to rapid removal of the exudate after the growth of the germ colonies has been inhibited. We have seen, however, that the germ colonies tend to invade other air-cells and bronchioles by spreading from the periphery of the consolidated area, and that these colonies give rise to the most virulent of the toxins. Those air-cells and bronchioles

which have been newly invaded are not yet consolidated, hence have not yet become solid tissue, and air circulates through them. It would therefore be impossible to raise the temperature of these parts very markedly if at all, and the inhibitory influence susceptible of induction in the fully consolidated portion could not be attained here. These colonies, therefore, would continue to multiply and spread until they had reached the end of their normal life period, and the system at large would continue to feel the effects of the toxins emanating from these areas, although relieved from those formed in the original and larger focus. As a consequence we should expect some fever, acceleration of pulse and respiration, general prostration, etc., to continue until the natural period for the termination of the attack had arrived, and this is exactly what happens. The patient being relieved from the intoxication from the greater bulk of the infective focus exhibits a marked and immediate improvement, but does not recover entirely until the infection has died its natural death.

It would be expected that central pneumonia, where a layer of functioning air-cells would be interposed between the focus of infection and the hot-air apparatus, would fail to respond to the treatment as well as the ordinary form where the consolidated area constitutes a practically solid tissue continuous with the external skin, thus facilitating conduction of the heat, and experience so far indicates that this is true. In the small number of cases of this variety of pneumonia that has been treated by this agent up to the present time the reaction has been much less satisfactory, and what benefit has been obtained was probably largely due to raising the temperature of the pleuræ and adjacent structures and to reflex influence dependent thereon.

It would also be expected that if the hot-air applications were discontinued too soon the germ colonies at the periphery of the original focus of infection would increase so as to produce some amount of consolidation and an increase in the systemic disturbance. As has been noted, this also is proven by experience to be true.

It is significant in this connection that the application of cold in the form of ice packed about the chest has been employed with benefit in this disease. This measure would unquestionably exercise a certain amount of inhibitory influence upon the growth of pneumococcus colonies, by lowering in some degree the temperature of at least portions of the consolidated area, but it would not stimulate absorption or metabolism to any great extent, if at all; hence would not produce the same beneficial effects as intense dry heat.

Another fact worthy of note is that Dr. Beverly C. Kinnear of New York City used heat with beneficial results in the treatment of pneumonia, in the form of hot-water bags or flannels wrung out of hot water, previous to 1898. His paper upon the subject was published in the Boston Medical and Surgical Journal for December 2, 1897. He made his applications over the dorsal sympathetic ganglia, and believed the effect to be due to reflex influence exerted upon and through these centers. It is possible, however, that the benefit was at least largely due to a greater or less inhibition of germ growth through the raising of the temperature of portions of the contiguous consolidation.

Treatment.

Hot Air.

The local application of hot air is usually the only thermo-therapeutical measure required in pneumonia, and the technique is as follows. A piece of cheap Turkish toweling,

four or five feet long and eighteen or twenty inches wide, is folded twice so as to make three thicknesses, and applied closely against the skin over the affected portion of the lung. This is held in place by two or three pieces of webbing one inch in width, supplied with buckles at one end, and long enough to pass clear around the body. The patient is then brought close to the edge of the bed and supported by pillows in such a way that the apparatus can be attached directly over the area to be treated. If the patient is a woman one of the webbing straps should be passed around the body directly under the breast, in order to retain the toweling well down into the hollow formed by the projection of this portion of her anatomy. It will be well to press the toweling against the skin with the hand frequently during the treatment in this situation anyway, else blisters are liable to form, because of the frequent impossibility of securing permanently close contact with the skin here, even with a well-applied belt. The heat should be run up to from 275° F. to 300° F., according to the patient's tolerance, and the length of the treatment should be from half an hour to an hour. Victims of this disease find it extremely irksome to lie in one position for an hour, but the treatment should be continued for this length of time if it can be done without provoking undue exhaustion, and judgment and experience must govern on this point. Treatments of less than half an hour are of little if any use.

After the treatment the capillary area which has been subjected to its influence will be found to have become deeply injected and covered with profuse perspiration. This secretion will also usually be in evidence on other parts of the body. It may be removed with a dry towel and the patient made comfortable again in bed, but no covering of the area treated



Patient Prepared for Local Application of Dry Hot Air to Left Lung or Pleurae.



Local Application of Dry Hot Air to Left Lung or Pleura.

or other after-applications are necessary. It will be seen that poultices and pneumonia jackets are entirely uncalled for when hot air is obtainable, hence the patient and his attendants are spared the great discomfort contingent upon their application.

When treating the lower lobe of the left lung it should be borne in mind that acute dilatation of the heart is sometimes induced by conduction of the heat to the organ through the area of consolidation. This phenomenon was exemplified during the treatment in the evening of March 31, in the case just cited. The pulse and respiration should be constantly watched, and if a sudden slowing of the rate occurs with a soft gaseous character of the former, the apparatus and wrappings should be immediately removed and the patient's body exposed and fanned. Usually this will take care of the condition in a few seconds, when treatment may be resumed. If the patient does not revive at once, towels wet in cold water should be slapped over the chest and abdomen and strychnia injected hypodermatically.

Occasionally a case is encountered where the patient's excretory organs are incapable of eliminating the toxins with sufficient rapidity, and a depression of nerve centers develops which threatens speedily to end the scene and the patient. This may be brought about by defective renal function, a low condition of the patient's vital powers when the infection was sustained, or a particularly virulent type of infection. Which ever the cause, the local treatment is useless, because it could not possibly influence the kidney when applied to the lung; the small area of skin subjected to its influence does not contain enough nerve endings to make possible a reflex stimulation of the spinal centers profound enough to overcome a general debility of this character, and as has been seen, the most virulent toxins emanate from the youngest colonies of germs, which are

so placed at the periphery of the area of consolidation as to be beyond the penetrative limit of the local application. The only resource then becomes the induction of rapid elimination from a large area of the skin, a rousing of the kidneys and lungs to increased function, and a strong stimulation of the spinal centers, which are being overwhelmed, and the body hot-air treatment enters the arena. As has been seen when considering its physiological action, it possesses the power to accomplish all of these objects in an eminent degree, and the method of its application is as follows.

The patient is prepared for treatment and placed in the apparatus, and the heat is run up as rapidly as possible to 275° F. or 300° F. If perspiration is not induced by this temperature the same should be increased until it is, or until the patient's tolerance is reached. The treatment should last from twenty minutes to three-quarters of an hour, according to the effect produced upon the patient.

As the temperature of the patient is usually already high when he enters the apparatus under these conditions, it is useless as a guide to the duration of the séance, and the pulse and general effects must be relied upon for this purpose. This is another situation where good judgment and experience are friends in need and indeed. In a general way, however, it may be said that the pulse should not be accelerated beyond 140 beats per minute, and that when sedation of the nervous system or dilatation of the capillary circulation—as evidenced by flushing of the face—has been produced, it is time to stop. Over-stimulation means exhaustion, which should be avoided, and a patient in the extremity we are considering is especially susceptible to its induction.

The after-care does not differ from that of the body treatment in general. The beneficial influence of the treatment

upon the heart and the nervous system is frequently apparent while the patient is in the apparatus, and it lasts from twelve to twenty-four hours usually. The application may be repeated when the patient begins to fail again.

The symptom of "heart failure" is sufficiently important to merit special notice in this connection. It is due either to massive exudate, or systemic toxæmia, or a combination of both. Massive exudate will usually yield to the influence of the local treatments with sufficient readiness to save the patient, but these applications are not effective in relieving the symptom when due to systemic toxæmia. The body treatment alone is efficient here, and in view of the fact that the patients almost always die under all other methods of treatment when reduced to this extremity, I consider it justifiable to move them in an ambulance from their homes to a hospital if they cannot be gotten to a body apparatus in any other way. As treatment would be applied immediately, any evil result of the exposure during the journey would be remedied at once, and the patient thereby gets the benefit of almost the only therapeutical measure that offers him a reasonable hope of recovery.

The condition known as hyperpyrexia very rarely occurs in pneumonia, as the strain upon the vital powers which precipitates it by exhausting the heat inhibitory centers is not usually continued long enough to induce the accident. The disease is usually characterized by a rapid crisis. When it does occur, however, the patient should be sponged with cold water just as it runs from the faucet, the body exposed and covered with towels wrung out of cold water and changed every few seconds as they become warm, or he should be immersed in the cold bath. I have found the second of these methods to be uniformly successful in my cases. If failure of the circulation

follows, as it sometimes will, a short body hot-air treatment will restore it better than whisky or even strychnia, and the slight rise in the body temperature induced thereby will subside kindly after the treatment is over. The body treatment used in this way will be mentioned again when typhoid fever is discussed.

Adjunctive Measures.

The other forms of physical therapeutics never enter the problem of the treatment of this disease when hot air is obtainable, but medicines are important. Professor A. H. Smith, cited previously, advocates the administration of drugs which are excreted largely by the lungs, and which are inherently inimical to the development of the pneumococcus. The extreme sensitiveness of this organism to conditions pervading its pabulum makes several drugs available for this purpose, among which may be mentioned creosote carbonate, the salicylates, large single doses of calomel, and quinine. Under ordinary circumstances the administration of these substances is not deleterious to the patient. The two first mentioned are Professor Smith's choice, and the clinical results noted are excellent.

The weak points in this method of attacking the germ are that some stomachs, kidneys, and nervous systems cannot stand the drugs advocated in sufficient quantities to render possible the induction of their antiseptic influence, and that medicines excreted in this manner do not penetrate to the germ colonies located in the consolidated area. They do, however, reach the youngest of the colonies which are spreading at the periphery of the consolidation and giving rise to the most virulent of the toxins. As we have seen, hot-air treatments exert their most powerful influence upon the area of consolida-

tion, hence, by combining these with the administration of appropriate germicidal drugs, we secure the most effective inhibitory influence possible at the present time.

The drug management of the symptomatic phenomena of the disease does not differ from that applicable under other circumstances. Strychnia, whisky, sanguinaria, or sanguinarin, small doses of tartar emetic, bryonia, phosphorus, etc., all have their places as stimulants, expectorants, etc., but when hot air is given they will sometimes never be indicated at all, and when they are it will be for a shorter time and in much smaller quantities than under other conditions. When the respiratory area has been greatly encroached upon, oxygen inhalations are extremely helpful and constitute a fairly efficient nerve stimulant as well.

The advantages exclusively dependent upon the use of hot air locally in pneumonia are as follows.

First, a powerfully inhibitive influence exerted upon the growth of the pneumococcus colonies in the area of consolidation, whereby the nerve centers are relieved from a large proportion of the toxin depression and irritation which result from their unimpeded development.

Second, a rapid absorption of the exudate, thereby diminishing the danger of cardiac distention and removing the symptoms caused by encroachment upon functionable respiratory areas.

Third, immediate removal of pleuritic pain, which is conducive to the patient's comfort, hence conservative of his vital energy. Also relief of that proportion of the cough and respiratory embarrassment due to the pleurisy.

Body Treatment.—First, elimination of toxins already formed and in the blood, to an extent and with a rapidity unattainable by any other means.

Second, a reflex stimulation of the vital powers and normal metabolism, also unparalleled in extent and profundity by any other measure.

Third, relief of the pulmonary circulation by a dilatation of the peripheral circulation, the extent and rapidity of which, again, are unsurpassed, if not unequaled, by any other measure now known.

Fourth, ultimate reduction of excessive temperature through removal of the conditions producing the same as hereinbefore described.

CHAPTER XV.

PERITONITIS.

It was the results of its application in a case of peritonitis that first suggested to the mind of the writer the thought that hot air might be useful in pathological conditions other than rheumatic ailments and traumatic joint affections. I have referred to the case already as having been reported in the New York Medical Journal, and the account following is taken verbatim from that periodical:

"Miss L. L., waitress. Was called to see the patient at 2 o'clock A. M., November 8, 1898, and found her suffering with severe colic. Had been feeling poorly and suffering from slight cramps in bowels for a week past. Abdomen was tense and tender, this last being especially well marked in the left iliac fossa. Bowels had been constipated for the past week. Pulse, 72; temperature, 98.6° F. Made provisional diagnosis of colic from indigestion and constipation, but, as patient was living in illicit relation with a man about town, and as I had met with some trying surprises in the way of gonorrheal salpingitis, peritonitis, and incipient appendicitis during my practice, I decided to call again and watch her progress. Administered morphine, a quarter of a grain, and ordered magnesium sulphate in teaspoonful doses hourly, to be begun in the morning and taken until bowels moved, and then discontinued. Patient was comfortable, so far as pain was concerned, in half an hour, and I returned to my couch and resumed my interrupted slumbers.

"Same Day, 6 P. M.—Found patient suffering acutely

from severe cutting pains all over abdomen; pulse 106; temperature 100.5° F. Abdomen tense, acutely sensitive to touch, but focus of tenderness still remained in left iliac fossa, which was entirely intolerant of manipulation because of it. I was unable to find anything specific in the neighborhood of the appendix, changed my diagnosis to gonorrheal salpingitis and general peritonitis, and was glad that I had called again. Morphine had controlled pain pretty well for four hours, after which it had returned, and continued with increasing intensity up to the time of my visit. Magnesium sulphate had produced two small, thin movements accompanied with sharp pains. I made up my mind that I was in for another of the usual harassing experiences which constitute the treatment of these cases, ordered that flannels wrung out of hot water be constantly applied to the abdomen, as hot as could be borne by the patient, gave her another hypodermic, left her two quarter-grain morphine pills to be taken in case the pain became unbearable, and put her on an exclusive milk diet.

“November 9, 12 M.—Patient had been suffering intensely since midnight. Knees were drawn up, abdomen much distended, unable to make the least movement without provoking excruciating agony, which was also occasionally exacerbated by attacks of retching, which accomplished nothing. She was shivering and her teeth were chattering from the exhaustion due to long-continued suffering. Pulse, 104; respiration, 28; very shallow and quick; temperature, 101.2° F. The morphine pills that I had left had not been used, as I had requested her not to take them unless it was absolutely necessary. With the proverbial capacity of her sex for enduring pain, she had not considered that the point of absolute necessity had yet been reached. I saw that something had to be done or the

exhaustion from this continuous terrible pain might kill her of itself. I hated to inaugurate a systematic course of morphine, with its resultant evils, particularly undesirable in a disease of microbic origin, where it is of the first importance to preserve the metabolic activities of the body unimpaired, but, as the hot applications were doing practically no good, it seemed the only measure capable of dealing with the situation.

"While I was considering, the attendant came to the bedside to change the flannels. The patient looked up at her and exclaimed, 'Oh, is it very hot?' Upon being assured that it was, she remarked, 'The hotter you get it the better it feels.'

"Like a flash my hot-air apparatus rushed into my mind. With it I could apply a heat of 500° F., whereas the flannels could not be used at more than 160° F. I quickly asked her if it was true that the greater the heat the greater the comfort she experienced. She answered that if the flannels were not very hot they gave her no relief at all. A small ray, that was hardly strong enough to be hope, brightened the darkness. If 160° F. of heat gave her some relief from pain, twice or three times that might give her a good deal, and by frequent repetitions I might be able to avoid the morphine. It was worth the experiment. I told her that I would try something else in the afternoon and did not administer any morphine.

"At 4.30 I applied hot air with doubt, fear, and trembling. My gratification can be better imagined than described when at the end of ten minutes the sufferer's face relaxed its pain-distorted lineaments. In thirty minutes she looked up at me with a quiet smile, saying, 'Oh, how good that feels!' and in forty-five minutes, while still under treatment, she had fallen exhaustedly asleep for the first time in thirty-six hours.

"At the end of treatment patient expressed herself as being entirely free from pain while she kept still, but when she moved

it was still there, and manipulation was as little tolerated as before. I left the apparatus there, directed that I be called immediately when the pain returned, and departed, walking upon air, because of the result achieved. I expected, of course, that a repetition would soon be necessary. However, I had been able to give her a relief so perfect that even morphine would have been inadequate for its accomplishment, and by withholding the drug had been enabled to preserve her mental and physical functions unimpaired. If I could keep this up I would be willing to treat her every hour if necessary. The hours wore on, and to my growing astonishment I received no summons, until by the following morning I began to fear that another physician had been substituted for me without the formality of my discharge having been observed. I found it difficult of belief that the treatment could have produced results so happy and so long continued.

" 10th, 12 M.—Patient greeted me smilingly, reporting that relief from pain had continued complete until nine o'clock the preceding evening, when for about fifteen minutes she suffered from slight cramps. At midnight she had severe cramps for an hour, but none since, and, to make a long story short, I will say that those were the last pains she suffered. The abdomen was relieved of its distention; tenderness upon pressure had entirely disappeared from the right abdomen, but was considerably in evidence in the left, and very much so in the umbilical region and below, from manipulation of which she shrank in terror. Bowels had functionated spontaneously and with little pain. Was taking milk freely and stomach was not at all irritable. Pulse, 72; respiration, 18; temperature, 98.6° F. Hot air was again administered.

" Same Day, 6 P. M.—Patient was and had been entirely comfortable. Pulse, 83; respiration, 18; temperature, 99° F.

Directed that I be called if pain appeared, and did not see her again until the next day.

" 11th, 10 A. M.—Patient had slept uninterruptedly all night and was feeling hungry. No tenderness anywhere in the abdomen except over a small area immediately inferior to the umbilicus. Pulse, 72; respiration, 16; temperature, 98.6° F. Hot air administered.

" Same Day, 9 P. M.—Patient has been sleeping some during the day. Entirely comfortable and only very slight tenderness on pressure in umbilical region. Pulse, 66; respiration, 18; temperature, 98.6° F.

" 12th, 8 P. M.—Found patient sitting up, dressed, sewing. No pain or tenderness upon pressure was anywhere discoverable. Pulse, 76; respiration, 18; temperature, 98.6° F.

" 15th, 8 P. M.—Patient called at my office by appointment. Pulse, 78; respiration, 20; temperature, 98.6° F. Examination reveals slight tenderness upon deep pressure over left Fallopian tube. Nowhere else. Escorted her upstairs to my operating room and once more administered hot air. Requested that she report in three days.

" 18th.—Reports that she returned to her work yesterday morning. Feels as well as she ever did in her life, and searching examination betrays absolutely no sign of her late illness. She wrote me a letter from another city two months later, in which she stated that she was and had been perfectly well since I last saw her.

" The felicitous results which I had obtained in this case opened my eyes to the fact that the sphere of usefulness of hot air was by no means confined to rheumatic affections. If it would thus profoundly influence the peritoneum why would it not produce like results upon the pleuræ, and even upon deeper tissues, the air-cells themselves."

All cases of peritonitis do not respond to hot air as kindly as did this one, but the incident shows of what the agent is capable in this situation. The disease is usually secondary to some other affection, as appendicitis, salpingitis, malignant tumors, etc. It is not infrequently due to infection of the peritoneum by tubercle bacilli, and is sometimes encountered during the course of the infectious fevers. Occasionally a case seems to be traceable to infection from the intestinal canal.

One of the most prominent and harassing conditions accompanying nearly all forms of peritoneal inflammation, except that due to the presence of the tubercle bacillus, is pain. Hot air will always relieve this symptom completely, and as it may be applied as often as the pain recurs the patient's comfort may be maintained indefinitely, and without any deleterious after-effects.

Inflammation confined to the peritoneum alone will usually yield kindly and permanently to hot air, but when it is secondary to some other condition, permanent removal will necessitate eradication of the exciting cause. When this is a benign neoplasm, operative interference must be considered; if the growth is malignant, operation or X-ray exposures, or both in many cases; if a septic process, as appendicitis, for instance, operation should always be considered early and earnestly.

In salpingitis coming under treatment moderately early and before suppuration has been established, the knife will rarely be indicated. The body hot-air treatment two or three times a week, in combination with the local once or twice daily, will usually effect a rapid and perfect cure, and the writer has seen several cases recover under local hot-air applications alone. The body treatment, however, always hastens the result, and in some cases its use is imperative. The deeply seated aches and pains due to the salpingitis itself are controlled by the body

treatment more effectually than by the local application in many cases.

The writer has never had the courage to rely upon hot air alone for the cure of appendicitis, but Burwash of Chicago reports two cases which he carried to a successful termination with this agent only. In reference to this disease, however, it seems to me that in view of the ever-present difficulty, if not impossibility, of differentiating clinically those cases of appendicitis which are due to impaction of a foreign body from those which are caused purely by germ infection, we should not feel justified in abandoning early operation for the treatment by dry hot air. If all cases were of the latter ætiological type hot-air applications would undoubtedly prove curative in the vast majority of instances, but they could not and should not be relied upon in the former. The agent is very effective in limiting inflammatory processes, and as the repair of wounds and abscess cavities is always greatly hastened by its use, it may be applied while waiting for operation and when the patient is sufficiently ill-advised to refuse operation.

In tuberculous peritonitis the occasional splendid results which have followed a simple laparotomy give ground for the belief that hot air will prove to be of benefit here. The most probable explanation of the way in which laparotomy has accomplished its effects seems to be that the absorptive power of the peritoneum, which is enormous under normal conditions, is rescued from a temporary inhibition by the operation, and that the congestion due to letting the membrane come in contact with the air or irrigating fluids renders possible the encapsulation and ultimate phagocytic destruction of the invading micro-organisms. Hot air possesses the power of inducing both restoration of absorptive power and congestion to a degree unapproachable by any other measure, and if this is the true

explanation of the effect of laparotomy the agent should be most valuable in this affection. The influence of body hot-air treatments in eliminating general toxæmia is as marked in this disease as elsewhere, and is of great assistance in securing a favorable termination.

Treatment.

Hot Air.

The local hot-air application should last an hour when it is possible to maintain it that long without unduly fatiguing the patient, and the temperature should be raised to from 350° to 400° F. The patient is prepared by bringing him to the edge of the bed, placing a piece of Turkish toweling five feet long and twenty inches wide and folded twice, so as to make three thicknesses, over the abdomen. This is kept in place by webbing straps such as were described in the preparation of pneumonia patients, which are passed around the body. The patient is then turned upon his side facing outwardly from the bed, and a pillow placed under the lumbar region, so as to prevent the sagging of the body in this region, due to the prominence of the iliac crests. The manipulation should be executed as gently as possible, any movement tending greatly to increase the suffering already present.

When this position has been attained it will be found that the webbing straps will require readjustment in order that good apposition of the Turkish toweling with the skin may be maintained. It will also be found that the sagging of the abdomen, due to the position, has caused a hollow to form immediately under the uppermost iliac spine, and into which the toweling will have to be pressed by crowding a napkin under the retaining strap in this situation. This hollow must be carefully watched during treatment and the covering frequently pressed



Patient Prepared for Local Application of Dry Hot Air to Abdomen.



Local Application of Dry Hot Air to Abdomen.

down upon the skin with the hand of the operator, or blisters will form.

The apparatus may now be connected and the heat turned on; in fifteen or twenty minutes the patient will be free from pain. When the application is finished the patient is merely made comfortable again in bed, no special after-treatment of the abdomen being required. The treatment may be repeated as soon as the pain returns, but should be applied twice daily anyway for the first four days, however comfortable the patient may be.

The technique of the body treatment in this disease does not differ from that usual to this procedure. As the body temperature is usually considerably above normal when the patient enters the apparatus it cannot always be relied upon as a guide to the duration of the séance or the intensity of the heat: the pulse acceleration and the general effect upon the nervous system must govern. As a rule the treatment should last about half an hour, and the pulse should be accelerated to 125 or 130 beats per minute. It is ordinarily not wise to push it beyond 140 beats per minute, and the phenomena indicating overstimulation should not be induced.

The frequency of administration is governed by the response on the part of the patient. It will usually be well to apply the measure every other day during the first week, after which the interval between treatments may be lengthened.

Aside from the ordinary care of the alimentary canal incident to this affection, surgical measures constitute the only means, aside from thermo-therapy, which will have to be considered in the treatment of peritonitis. When the exciting cause is a salpingitis, long-continued intra-vaginal applications of the rapidly interrupted current from the long, fine wire coil through the bipolar electrode, will some-

times give temporary relief from pain, but the writer has not infrequently seen suffering increased for several hours thereby, and its use is not to be recommended in all cases. The administration of anodynes for the relief of pain is almost never called for, and drug stimulation is entirely superfluous when a body apparatus is at hand and usually when the local treatment is employed.

The advantages exclusively dependent upon the employment of hot air in peritonitis, viz., rapid relief of pain, restoration of absorptive function to the membranes, etc., have been sufficiently dwelt upon to warrant omission of further mention, and anyone who has carried a patient through an attack under ordinary therapeutical measures will readily appreciate the value of the services it renders.

CHAPTER XVI.

PLEURITIS AND SYNOVITIS.

Pleuritis.

Of the pleurisies ordinarily encountered it may be said, as of peritonitis, that they are usually secondary to some other affection, as pneumonia or pulmonary tuberculosis. These pleurisies yield rapidly, both in their symptomatology and intrinsic pathology, to local hot-air treatments. As in peritonitis also, however, it is evident that their permanent cure will necessitate removal of the exciting cause. But there is not infrequently encountered another class of pleurisies which seem to originate in the membranes themselves primarily and which are at times most refractory. They are accompanied by effusion into the pleural cavity, and may be divided for thermo-therapeutical purposes into two classes, viz., those in which the effusion is serous or fibrinous, hydrothorax, and "dry pleurisy"; and those in which the exudate consists of pus.

The treatment of the latter form is, always has been, and of course always must be, operative interference. Many cases, however, refuse to recover even when resection has been done, and there is reason to believe that hot air is capable of reducing the number of these incurables, and of greatly hastening recovery in all of them. As these patients are usually debilitated subjects, it is always wise and sometimes necessary to invoke the influence of the body treatment upon general metabolism, as well as the direct effect of the local application upon the pleuræ. The technique does not differ from that applicable

in pneumonia, and the frequency of administration depends upon the patient's response.

Enough cases of the two first-mentioned varieties have been treated to demonstrate that this agent is capable of rendering valuable assistance here, that aspiration will have to be done less frequently in the future, and that when it is done the return of the pleural membranes to normal function will be quicker and more frequent than it is at present. A very convincing case was reported by Burwash in the *Chicago Medical Recorder* for December, 1901. The diagnosis indicated by the physical signs was confirmed by withdrawing some of the fluid through an exploring needle, and the patient was ill but four weeks from the inception of the attack to its termination. The effusion was extensive enough at one time to produce dyspnoea and interference with the heart action. The local application only was used, and diuretics and strychnia were administered in combination therewith.

Treatment.

The local treatment should be used twice daily for an hour at from 350° to 400° F., until improvement is manifest, and once daily thereafter until recovery is complete. The preparation of the patient and the technique are the same as have already been described in the section on pneumonia. When possible the site of the inflammation should be located and the treatment directed upon that spot.

The body treatment should be applied two or three times weekly, according to the effect upon the patient's general condition, and the technique is that usual to this procedure. As the bodily temperature is not ordinarily much elevated in this affection its fluctuation during the séance will usually be of

value in determining the length of the treatment and the intensity of the heat.

The other methods of physical therapeusis are rarely of value here, and the dietary and drug management do not differ from those commonly incident to the affection, except that anodynes and stimulants are very rarely called for when hot air is attainable.

Synovitis.

The vast majority of synovial inflammations are due to one of four ætiological factors, viz., trauma, rheumatism, gonorrhea, or tuberculosis. The writer's experience with hot air in this affection has been confined principally to cases owning the three first-mentioned exciting causes, and it has been eminently satisfactory. Walton has reported most excellent results in tuberculous synovitis, and the physiological action of the measure would lead us to believe that it would render valuable assistance in managing this most discouraging disease. It has been said that hot air is contra-indicated in joint tuberculosis, but this statement is fallacious and is not warranted by the pathology of the condition, the physiological action of the agent, or clinical experience.

It is hardly necessary to state that a case of traumatic, or any other synovitis for that matter, should be gotten under treatment as early as possible. If it is attacked within three or four days after the injury has been sustained, the traumatic variety will ordinarily reach a successful termination within three weeks. I have never seen one last over six weeks, even when ten days had elapsed since the injury, and Corwin has reported one case of acute synovitis of the knee in a boy fifteen years old, exciting cause not stated, which recovered completely with but two treatments. It is the writer's belief, how-

ever, that such a rapid response is very rare, and he has personally never seen a case of true synovitis recover in such a short time, however early it came under treatment.

In the rheumatic variety, on the other hand, rapid response is the rule where appropriate medication accompanies the hot air, and recoveries with but four or five applications are not at all uncommon.

In gonorrheal synovitis it is of course essential that treatment be directed against the primary focus of infection as well as the joint mischief, but the use of hot air on the joint affected will greatly hasten the recovery, and ankylosis will almost always be avoided thereby. This is one of the situations where the agent cannot invariably be relied upon to effect immediate relief of pain. It sometimes makes it worse for several hours afterwards. The ultimate result makes its application advisable, however, unless the pain is exacerbated to an unendurable degree.

Tuberculous synovitis is the most resistant of the varieties to this as to all other methods of therapeusis, as would be expected from the pathological character of the disease. A cure requires from two to six months, but in the cases so far reported the joints have eventually been restored to useful function, and that without operative interference. If surgery has finally to be called upon, the prospect of ultimate cure is greatly increased, because of the improvement in the local nutrition due to the course of hot-air applications.

It is probable that hot air produces its beneficial results in joint tuberculosis by improving the nutrition and increasing the cell vitality of the part, rather than by a directly fatal influence upon the bacillus itself, as has been suggested. If the germ were directly destroyed by the heat the recovery would be immediate, whereas it is in fact always found to be slow.

Treatment.

The knee is the joint most frequently affected and the local application is the one most frequently called for. The apparatus designed especially for this joint would seem to be the one most useful in this situation, but for the reasons stated in Chapter III. the general local apparatus will give better results when the joint is susceptible of sufficient extension to permit of its use. It is probable that the greater clinical benefit secured by using the general local instead of the knee apparatus is largely due to the heating of that portion of the member below the joint, whereby a greater amount of reflex and direct influence upon the nutrition of the part is induced than when the joint only is treated, as well as to the greater degree of heat which it is possible to apply with this machine.

In the varieties due to rheumatism, trauma, or tuberculosis the local application may almost invariably be confidently relied upon to relieve pain entirely and at once, and in the two first-mentioned, the inauguration of convalescence usually coincides with the first application. As hereinbefore noted, however, this measure will not always relieve the pain in the gonorrheal variety.

When the knee is the member affected and the apparatus used is the one designed especially for this region, the technique is that described in Chapter III., in the section which treats of this apparatus.

When the general local apparatus is used the wrapping should be started at the toes, and the whole of the limb, from the toes to a point a little above the middle of the thigh, invested in three thicknesses of the toweling. The limb is then placed in the apparatus, the limiting attachment fastened around the middle of the thigh, and the heat run up to about 400° F.

Whichever apparatus is used, the treatment is continued for an hour, and administered twice daily, or oftener if the pain becomes troublesome.

After the treatment it is wise, in the traumatic variety, to wrap an elastic bandage about the joint just tight enough to produce an even, slight pressure, and this should remain until the next treatment.

When the exciting cause is gonorrheal infection, the persistent pressure of the elastic bandage can rarely be borne, but it is advisable to secure immobility of the joint by applying a splint or some retaining apparatus, until the acute inflammatory process has subsided. Passive motion may then be employed immediately after each treatment.

In rheumatic synovitis no compression or immobilization device is called for. It is desirable only that the patient refrain from moving the part, and this he will ordinarily do of his own volition.

Whether or not immobilization shall be used in tuberculous synovitis must be determined by the conditions obtaining in the individual case.

The body hot-air treatment is always extremely helpful in synovitis of any sort, but it is rarely imperatively indicated in cases due to trauma or rheumatism. In gonorrheal cases, however, recovery is always markedly hastened by its employment, and very frequently a satisfactory result cannot be attained without it. We have here a condition comparable in many respects with that obtaining in local septic infection, and the technique of the application here is the same as that described when considering that affection.

Much the same may also be said of tuberculous synovitis, in which disease the writer is of the opinion that body hot-air treatments should always be employed. We have here not

only a localized process, but an insufficiency of the vital processes generally, and as we have seen, no measure is more effectual in combating a general debility than judiciously applied body hot air.

Adjunctive Measures.

Electricity, in the form of the Morton static wave current, the static spark, and galvanism, is very useful in traumatic and rheumatic synovitis, the efficiency of the modalities being in the order in which they are named. The high-frequency current has been used considerably abroad and good results reported, but hot air, alone or in combination with one of the above-mentioned modalities, will ordinarily give results which leave little to be desired.

The Morton wave current or the brush discharge will frequently give good results in relieving the pain of the gonorrheal variety, but operative interference constitutes the most important curative adjunct to be considered in this condition.

The dietary and general management of a case of synovitis that is being treated by hot air does not differ from that ordinarily indicated, except in the greatly lessened frequency with which pain-relieving drugs are required.

CHAPTER XVII.

LITHÆMIA; NEURALGIA AND MYALGIA; VARICOSE ULCERS.

Lithæmia.

This term is sometimes used as a synonym of gouty diathesis, but the two conditions are not strictly identical. The latter term should be restricted to the condition occurring in persons who inherit the tendency to impaired trophic nerve function which results in suboxidation of metabolic products, and which usually goes on to eventuate in paroxysms of true articular gout; while the former should be used to indicate a condition in which the presence of suboxidation products in the system is the result of errors in living in one whose heredity is untainted, and in whom the condition has not existed long enough to induce the characteristic constitutional phenomena of true gout.

Although the symptomatology of these two classes is nearly, if not quite, identical in their early stages, yet the prognosis and response to treatment are very different. In lithæmia the natural tendency is toward recovery, and if the exciting causes, viz., excesses and faulty habits of life, are corrected, the condition will disappear. If, on the other hand, the patient persists in his errors, the condition may go on to the production of a true gout, or one of those diseases so closely allied to it—diabetes mellitus or obesity; or he may become a neurasthenic wreck. A surprisingly large proportion of the neurasthenic cases encountered are traceable to impaired function of the trophic nerve centers, dependent upon a systemic toxæmia induced by intestinal indigestion or inability to do the work forced

upon them, of some other of the viscera concerned in the nutrient function—in short, the presence in the body of an intolerable amount of the products of suboxidation.

In the true hereditary gouty diathesis the tendency is not towards recovery, but towards a gradual increase in the frequency of occurrence and severity of the symptoms. The vitality of the trophic centers is constitutionally impaired, and however careful the victims may be in their habits of living, the majority of them ultimately become chronic invalids and die of nephritis, apoplexy, or some other gouty finale, after months and sometimes years of suffering.

As far as we now know, however, the neuralgias, dyspepsias, hemorrhoids, chronic bronchitis, etc., of lithæmia, and the true gouty diathesis in its early stages at least, are due to the self-same direct ætiological factor, suboxidation. Confirmatory of this view is the fact that all the measures which have ever been productive of anything like permanently satisfactory results in these conditions have had increase of metabolism, *i. e.*, oxidation, as one of their prominent effects, or decrease of the matter ingested which would put an undue burden upon the oxidative capabilities of the organism, as their object. Regulation of diet, combined with judiciously directed exercise, has always been the sheet anchor in treatment.

Chemical experiment and clinical experience have also shown that increasing the alkalinity of the blood renders more soluble, and hence susceptible of excretion, the suboxidized products present in lithæmic subjects, and the alkali-lithia preparations have gained reputation in the treatment of the condition because of their capacity for accomplishing this end. The large amount of water which accompanies their administration also facilitates removal of the offending matters by its solvent influence in the tissues of the body and its diuretic effect upon the kidney.

Treatment.

From the foregoing it will be seen that the management of lithæmia resolves itself into the employment of measures tending to secure, first, a limitation of the nitrogenous matter ingested; second, an increase in the oxidation processes whereby waste products retained in the blood and tissues may be rendered more susceptible of excretion; and third, a rehabilitation of the trophic nerve centers, functional impairment of which has maintained the derangement of metabolism throughout the organism.

The first object is attained by regulating the diet according to well-known rules. For the attainment of the second there is no measure equal to the body hot-air treatment, either in efficiency or rapidity. We have already noticed its powerful influence in stimulating metabolism and in rehabilitating, reconstructing, and invigorating an exhausted nervous system, hence a mere mention of the facts will suffice here. One other effect of the body hot-air treatment which merits consideration here, however, has not been specifically referred to before, and that is its power to increase the alkalinity of the blood. As noted previously, increase in alkalinity is very helpful in transforming the insoluble products of imperfect oxidation into soluble forms which are susceptible of excretion. This it accomplishes through the profuse perspiration induced, which is strongly acid in reaction. The rapid withdrawal of such a large quantity of fluid from the body also plays no small part in the general metabolic stimulus excited, by reason of increase in volume and rate of the circulation of all the fluids in all the tissues of the body. In this connection it acts the same as general massage, but much more profoundly.

Elevation of the body temperature is rarely if ever present

in uncomplicated lithæmia, hence the technique of the body treatment is simple, and has been fully described in the section devoted to that subject. Modification will be required only with those patients whose arteries have become atheromatous, and then only to the extent of using a less intense degree of heat and running it up more slowly for the first three or four séances. The degree of heat eventually attained should be 350° F., and the time period of the application should depend upon the pulse acceleration and the degree of hyperthermia induced.

Other physical measures which are efficient in removing the primary pathology of lithæmia are the static electrical modalities and hydrotherapy, but in the writer's experience no one of them has equaled body hot air. The static modalities are of very great assistance in combination with it, however.

The mineral waters and salines are the best agents to employ against the constipation which is usually present, and this condition should invariably be looked to. Free action of the bowels is of the utmost importance in lithæmia. Judiciously regulated exercise is a necessary accompaniment of all kinds of treatment, as is also the ingestion of plenty of pure water.

Immediate symptoms, such as neuralgia, indigestion, irritable bladder, etc., will rarely call for special attention after the first week of hot-air treatments, but when they do their management does not differ from that ordinarily applicable.

It is not inappropriate in this connection to say a word about the use of hot air in true gout. The writer has had very little experience with the agent in this disease, but Walsh of Edinburgh, Scotland, has used it a good deal, and he speaks of it as follows:

“The present writer has witnessed remarkable results following the application of the superheated air in gouty cases.

It will control even acute gout, and in one case an incipient attack in the great toe was treated with so much success that the patient, a stockbroker, was enabled to keep his engagement at a shooting party next day. That result will speak volumes to all who are familiar with acute gout. In advanced and chronic cases the restoration of movement and return to health has often been of a most striking nature. Under the superheated air uratic deposits and enlarged bursæ often vanish.

“A somewhat extensive experience has convinced the present writer that the Tallerman method yields curative results in gout that cannot be approached by other therapeutic measures.”

It would seem that the physiological action of hot air was particularly well adapted to remove the pathological conditions obtaining in true gout, and the results that have so far followed its use give ground for the hope that it may prove to be of value upon further acquaintance.

Neuralgia.

In the treatment of no condition is a correct diagnosis of causative factors more essential than in that of the various neuralgias. As the scope of this article does not include diagnosis, the truth of the above statement will merely be indicated by calling attention to the fact that neuralgia may be provoked by a variety of causes, prominent among them being general debility resulting in impaired nutrition of certain nerve trunks; the presence of abnormal substances in the blood as exemplified by the neuralgias accompanying lithæmia, plumbism, the excessive use of tobacco, and the infectious fevers; certain degenerative processes in the spinal nerve-tracts; degenerative changes in the nerve trunks themselves, and pressure from tumors. Another rare cause is disease of some of the internal organs, which produces the sensation of

pain in the remote distribution of a nerve trunk, the pain-conducting fibers of which are so situated in the cord as to be susceptible of influence by pain impulses traversing the nerve supply of the affected organ, the so-called "referred pains." A familiar example is the unilateral headache sometimes caused by hepatic congestion or intestinal indigestion.

Treatment.

The first step is to diagnosticate the cause, as this must be removed before permanent benefit can be secured. Hot air enters the problem in two ways: it is efficient in removing some of the primary causes in the form of the body treatment, and in mitigating the local condition in the form of the local application. I will say here that, as the agent cannot be applied directly to the head, it is useful in cephalalgia only when this is dependent upon some systemic condition which is amenable to the influence of an application to the body.

In the neuralgias of general debility body hot-air treatments are of transcendent value. The pains usually lessen and sometimes disappear entirely during the first séance while the patient is in the apparatus, and not infrequently the removal is permanent. Its influence in this situation is of course due to rapid tissue reconstruction throughout the body, and the determination of a large quantity of blood laden with nourishment to the starving nerve. When the painful part is accessible, as the intercostal nerves, for instance, the local application will almost always relieve at once, and sometimes the result is most happy as to permanence. The writer has seen an intercostal neuralgia of fifteen years' standing entirely cured by three local hot-air treatments.

Neuralgias due to the presence of abnormal substances in the blood will nearly always yield temporarily to local treatments

when in accessible situations, but their radical removal will usually demand the body treatment. This acts, of course, through its power of inducing rapid elimination, as well as sedation of nerve irritation and restoration of normal metabolism. Enough work has not yet been done with it in the neuralgias accompanying the infectious fevers to make reliable conclusions possible, but the data now at our command would indicate that it possesses some usefulness in this connection.

Local applications of hot air will sometimes afford temporary relief in pain affecting the distribution of nerves pressed upon by tumors, but only removal of the primary cause, of course, will result in cure.

The technique of both body and local treatments in neuralgia is simple, and has been fully described in Chapter III.

The electrical modalities, especially the static, vie with hot air in the treatment of neuralgias, and in some situations, as about the head, supplant it entirely in most cases. Where it is appropriate, its much greater convenience of administration makes it preferable to hot air, and it is always of value in connection with it. Temporary relief of pain, at least, can almost always be secured by electrical applications, and cases of even the intractable tic douloureux have been reported as cured by them. The writer has never seen a case of true "tic," however, in which anything short of resection of the nerve or total removal of the gasserian ganglion afforded complete and permanent relief, but it is sometimes a matter of great comfort to be able to afford these sufferers even short respites without operation. Hot air has so far scored no successes in this affection.

The medicinal treatment appropriate to the various primary conditions causing neuralgias should accompany the physical measures, and the final result is much hastened thereby.

Neither alone will accomplish the results attainable with both together. As indicated previously, surgery will also have to be called upon at times to extirpate exciting causes, as tumors, etc.

Myalgia.

Myalgia is really a neuralgia affecting the nerve fibers ramifying in a muscle. It is usually due to systemic toxæmia of some sort, and the treatment is the same as for neuralgia in other situations. The static wave current or spark will alleviate the pain more rapidly and thoroughly than any other measure, and the body hot-air treatment stands pre-eminent among the means for removing the primary cause.

Varicose Ulcers.

Varicose ulcers are directly due to impairment of the local nutritive function, but this in turn is due to constitutional debility or degeneration of some sort, and the gouty diathesis and lithæmia play an important part as predisposing causes in many cases. The direct ætiological factor is most frequently traumatism, the effects of which the crippled circulatory function is unable to repair.

Local applications of hot air constitute one of the most effective single measures known for the local management of the condition, and in ordinary cases will effect a cure in from three to six weeks. The cure will not usually be permanent, however, unless the constitutional condition upon which the local lesion depends is also removed.

The technique is that usual to the local treatment, except that the temperature rarely need be higher than 300° F. The frequency of application will depend entirely upon how the sore responds. At the beginning it should be applied every other

day. If no improvement is noted at the end of ten days it may be increased to every day. When appropriate constitutional treatment has accompanied the local hot-air applications, the case will be a rare one which does not exhibit marked improvement in three weeks.

It is always wise and sometimes necessary to administer the body hot-air treatment once or twice weekly to patients suffering from varicose ulcers. We have already considered the different phases of its physiological action, hence it is only necessary to recall the constitutional ætiology of varicose ulcer in order to appreciate the manner in which the body treatment is beneficial.

The electrical modalities alone are of great assistance in the management of the condition under consideration, but in combination with hot air their effectiveness is doubled. The negative pole of the galvanic battery, applied directly to the ulcerating surface, with from two to ten milliamperes of current according to the patient's tolerance, is extremely effective in producing repair of the local lesion. Enough current to cauterize should not be used. Electrolysis is what does the work, and cauterization will but hinder progress.

The static wave current localized upon the sore is nearly as effective as galvanism and possesses the advantage of exerting a marked constitutional influence for good. The brush discharge is also very effective, in some cases appearing to do even better work than the wave or galvanism. Sparks to the ulcer enjoy something of a reputation as a curative measure, but the writer has seen ulcers that were attempting to heal repeatedly break down again under their application, and has abandoned them entirely in this connection. The high-frequency current bids fair to prove useful, but it has not yet been used enough to make reliable conclusions possible.

The administration of appropriate drugs for their constitutional effect, and the application of appropriate antiseptic dressings, should always accompany the physical measures, but strapping or other stimulating measures are entirely uncalled for.

CHAPTER XVIII.

NERVOUS DEBILITY AND EXHAUSTION; NEURITIS; CHRONIC BRONCHITIS; PULMONARY TUBERCULOSIS; FIBROUS ANCHYLOSIS.

Nervous Debility and Exhaustion.

The condition meant here is the neurasthenia due solely to excessive nerve strain, and is encountered in individuals who have overworked and sometimes in women who are passing the climacteric.

The object to be attained by treatment is the reinvigoration of nervous tissue, which has become exhausted to an unmanageable degree of irritability and impaired functionation, by the production of new cells which are capable of normal function. This can only be done, of course, by calling into activity the metabolic functions. As we have seen, the body hot-air treatment stands pre-eminent as a stimulant to metabolism, and would seem to be an ideal measure for the removal of nerve debility of any degree. Experience proves this to be so. When the patient comes under treatment before the debility has become an exhaustion, it is not necessary for him to stop work entirely, even. One or two body treatments a week with a strychnia tonic will usually restore him to health in short order.

When the initial condition has been neglected or inefficiently treated, however, and the point of exhaustion has been reached, the problem assumes a different aspect both as to management and duration. The most prominent symptoms now exhibited

are insomnia, more or less melancholia usually, inability to fix the mind upon any one subject for any length of time, physical exhaustion upon slight exertion, all sorts of aberrations in the sensory sphere, and gastric and intestinal indigestion.

The last-mentioned phenomena, primarily due to impairment of the nerve centers controlling the digestive ferment-producing glands, react upon the organism by throwing into the blood current imperfectly metabolized substances, thereby maintaining the depression of the central nervous system.

Usually the first thing to do now is to secure a complete change in the patient's surroundings and mental habits by removing him from his home and placing him in an environment which will admit, as nearly as possible, of entire freedom from care and undue physical exertion. Supply him plentifully with plain, nutritious, easily-digested food, selected according to the idiosyncrasies of the individual case, and give him a body hot-air treatment two or three times a week. A judicious amount of exercise is also very beneficial in most cases.

Static electricity is most useful in combination with hot air in all grades of neurasthenia, and its beneficial influence is not looked upon as due entirely to suggestion by those who have used it very extensively. The wave current is the most useful of the modalities in the early stages of the affection, and may be applied twice daily; in the morning localized over the solar plexus and in the evening over the spine. When the nervous condition has improved some, static sparks may be applied over the spine and general surface of the body, preferably in the morning. On the days when hot air is administered one of the electrical treatments may be omitted.

The combination of these two measures, with galvanization of the brain and spinal cord twice weekly and regulation of the gastric and intestinal functions, has given me more satisfaction

in the treatment of neurasthenia than any other measures that I have ever used.

It may not be amiss to mention in this connection that convalescence from the acute exhausting diseases, such as pneumonia and typhoid, and which, especially in the latter, is sometimes greatly prolonged, may be hastened in the most gratifying manner by the use of body hot-air treatments and static electricity.

Neuritis.

This affection is another of those owning a varied ætiology. Prominent among its causes are excessive use of certain sets of muscles and nerves which is exemplified by the brachial neuritis sometimes encountered among penmen; the presence of abnormal substances in the blood, illustrated by the neuritis of alcoholism, plumbism, and the infectious fevers; and traumatism. Lithæmia and other constitutional aberrations are also met with among its causative phenomena, and there can be no doubt that sudden chilling of the body under certain conditions will inaugurate an attack, although the manner in which it does so is not entirely clear. A neuralgia so induced would not be difficult to understand, but in the case of a true neuritis it would seem as if something else must also be ætiologically involved, and it is probably through an inhibitory influence of cold upon general metabolism, whereby abnormal and irritating products are developed in the circulation, that the attack is provoked. It will readily be appreciated that removal of the exciting cause is frequently a necessary factor in the attainment of a cure.

The use of hot air in neuritis is on the whole somewhat disappointing. The local application will nearly always relieve the pain for a time, but it almost invariably returns after a

little as badly as ever, and I have never been able to convince myself that it possessed much if any value as a curative agent. The body treatment is more useful, however, and especially in those cases dependent upon constitutional causes it is fairly efficient. Even at the best, however, hot air alone is not a very reliable measure.

The best results are attainable with the electrical currents in combination with hot air, and my routine treatment is to apply the body treatment two or three times weekly and some electrical modality twice daily, except on the hot-air days, when one electrical treatment is omitted. The local hot-air treatment is used *ad libitum* when the pain is troublesome.

The electrical modalities used are the static wave current, the brush discharge, and spray in recent cases, and sparks and weak galvanic currents in chronic cases. Some authorities do not countenance the use of galvanism in neuritis, and in many cases it will unquestionably make the trouble worse. In other patients, however, currents of from three to ten milliamperes will just as unquestionably produce beneficial results, and if a case is not doing well under other measures I believe that it should be cautiously tried.

The rapidly interrupted current from the long, fine-wire coil is excellent for sedation, but I have never observed that it exercised much if any curative influence in true cases of this disease.

Drugs are not efficient against a neuritis *per se*, but they are useful for removing some of the constitutional conditions upon which it frequently depends, as lithæmia, plumbism, etc., and for relieving pain. They will rarely be required for the latter purpose when hot air and electricity are available, but when they are required the coal-tar derivatives will usually give good satisfaction. As the affection very frequently becomes

chronic, the administration of morphine should be reserved for a last resort, and given most guardedly then. Its after-effects are frequently most vicious as far as the neuritis itself is concerned, to say nothing of the very present danger of making an *habitué* of the patient.

The regulation of the diet will depend upon the conditions obtaining in the individual case as regards idiosyncrasy, and whether or not constitutional and diathetic factors are involved in the ætiology. Rest of the parts is always helpful and sometimes imperative for restoring the nerve to its normal condition.

Chronic Bronchitis.

Another disease of diverse ætiology. When due to general debility, as when it follows after la grippe, or to constitutional aberrations, as lithæmia or the gouty diathesis, body hot-air treatments are very effective in removing it. The local hot-air application, administered as for pneumonia, also possesses considerable value in the treatment of this affection. The technique of either treatment requires no special modification. The general tonic, corrective, and eliminative influences of body hot air are well supported here again by general applications of static electricity, the wave current to the spine, sparks to the spine and chest, etc., but the inhalation of ozone has proven to be something of a disappointment to most of us. It is of benefit in some cases, however, and should always be tried if a patient is not responding well to other measures.

The ordinarily indicated drugs should always accompany the physiological measures. In this, as in rheumatism and several other diseases that have been noted, the physiological measures render the drugs active by so influencing the organism as to

remove conditions that cause medicinal agents, unaided, to be inefficient. Neither alone will do the work that can be accomplished by both together, and non-tuberculous chronic bronchitis is sometimes intractable enough to require all the resources at our command for its removal.

Pulmonary Tuberculosis.

The only therapeutical measures that have been proven to be of substantial benefit in consumption are those that improve the general condition and increase the nutritional processes of the patient. As we have seen, the administration of one or two body hot-air treatments a week is very efficient for this purpose, and it is my belief that this measure will play a not unimportant part in the treatment of this disease in the future. The establishment of tuberculosis sanatoria throughout the country, and for that matter throughout the world, is attracting daily more and more favorable attention, and the realization of this most desirable method of handling the disease is probably not far away. In institutions of this character, where the environment of the patient, his daily habits, etc., would be carefully arranged and directed so as to secure the most favorable conditions possible for his improvement, hot air could be administered so as to utilize all of its powers.

I have not subjected many patients to this treatment, because the climatic conditions obtaining in this region are among the worst possible for such cases. I always send them away immediately when they can go. Some are not able to go, however, and then we have to do the best we can under the circumstances.

Although body hot-air treatments have not cured any of the patients that I have had under observation, yet they have done

a great deal in the way of increasing strength and improving the general condition. The appetite and assimilation of food have been improved, whereby a diminution of the rapidity of the progress of the disease has been secured and life prolonged. I have seen a patient who was so weak when brought under treatment that she would consume half an hour in ascending a flight of twenty stairs, and who could accomplish scarcely more than that many steps on the level without sitting down to rest, improve in a month to such an extent that she was able to ascend two flights of stairs without stopping and could go off and take trolley rides alone by herself. Hot air appreciably lessens the cough, the patient sleeps better, feels better, and usually gains some in weight. After the first period of improvement, however, the patient begins slowly to fail again, and continues steadily so to do until the usual termination obtains. These observations apply only to advanced cases, as, for reasons previously stated, I have never subjected an incipient case to the treatment.

It has been suggested that the improvement observed was due to psychical influence, but I do not consider this explanation to be the true one. It is an undoubted fact that a consumptive will improve generally for a short time under any new line of treatment, but the improvement does not continue steadily for from six to eight weeks and is not accompanied by gain in weight, lessening of cough and expectoration, etc., as is the case when body hot air is administered. The improvement dependent upon psychical influence usually, in my experience, has lasted about one and rarely more than three weeks, after which the patient's condition is all at once as bad as ever again. When the decline begins again after the improvement from hot-air treatments, it is slow and gradual, showing constantly decreasing systemic resistance, and sometimes it requires two or three

months to reduce the victim to the condition he was in before beginning treatment. Judiciously and thoroughly administered body hot-air treatments are worthy of extended trial under favorable climatic and hygienic conditions in pulmonary tuberculosis.

The local application of hot air is most satisfactory for dealing with the secondary pleurisies of tuberculosis, and a certain amount of general benefit follows its use. At first sight it would seem as if we might expect the same benefit to follow its use in consumption as in pneumonia, but experience does not bear out the inference. We have in phthisis a condition similar to that obtaining in central pneumonia as far as the bulk of the pathological tissue is concerned, viz., the foci of infection are separated from the hot-air apparatus by layers of functioning air-cells. Across these, as in central pneumonia, it is of course impossible to conduct the heat; hence the infected tissues cannot be reached. The heat can easily be conducted to the pleuræ, however, and the rapid and satisfactory manner in which the local application extinguishes these painful and debilitating secondary outbreaks of the infection is a source of great comfort to the physician as well as to the patient.

X-light passed through the affected lung tissue three times weekly has apparently produced some extremely good results in tuberculosis. Rudis-Jicinsky has reported curing sixteen out of a series of twenty cases of incipient tuberculosis pulmonalis by this method, and his cases had remained well two years after, as far as could be observed. Other observers have not had such a large percentage of cures. The author has treated three cases with X-rays. One of them has steadily improved; another has continued to grow slowly worse, although I believe that the rapidity of the progress of the disease

has been checked; the third has died, showing apparently no effect whatever from the rays. The favorable results that have been attained, however, make it worth while to give X-light a trial, however small the percentage of benefit that might be obtained.

The inhalation of ozone, generated in a special apparatus from the static electrical current, is spoken of most highly by some observers, but it has not yet been used sufficiently to make a reliable judgment possible. The writer has not been able to convince himself that appreciable benefit followed its use in cases under his observation.

The general nutritional applications of static electricity, cod-liver oil and other drug tonics, chief among which may be reckoned strychnia, as well as every other known means of increasing general vitality and bodily vigor, should be used in the treatment of tuberculosis. As suggested previously, it is probable that consumptives will in the near future be taken care of in specially arranged and located sanatoria where all of these measures can be applied in combination and to the greatest advantage, and not until then can we hope to see very satisfactory curative results in a large proportion of cases follow the use of the remedial measures known at present.

Fibrous Anchylosis.

It has been stated that this condition, when occurring in the larger joints, was not amenable to the corrective influence of hot air; this statement was erroneous. One of the writer's early hot-air cases was a fibrous ankylosis of the knee, occurring in a boy eleven years of age, and resulting from five weeks' confinement of the joint in a splint applied for a fracture of the femur immediately above the condyles. He had been etherized when the fracture was put up,

and the after-effect was so prolonged and severe that his parents were unwilling to have the experience repeated. The joint was exquisitely sensitive, however, and the adhesions could not be forcibly broken up except under an anæsthetic. I administered fourteen local hot-air treatments, following each with a few minutes of passive motion, the excursions being susceptible of a little increase after each successive séance, and the knee regained its normal mobility. Subsequent experience has shown that the body treatment is of great assistance in combination with the local application in removing this condition. Several other observers have reported cases of fibrous ankylosis in which hot air effected a satisfactory termination, and its favorable influence over the condition is established beyond question.

The local treatment should be applied every day for a week, and then every other day until recovery has taken place. Five or ten minutes of passive motion should follow each treatment, the joint being flexed as much as possible without causing the patient undue suffering. If troublesome inflammatory reaction follows this manipulation, the hot air should follow instead of precede the stretching of the adhesions. The body treatment two or three times weekly will greatly hasten the absorptive process. Both body and local applications act by stimulating absorption through influence exerted upon the metabolic function.

The static wave current, static spark, and galvanism are efficient in combination with hot air in hastening the process, in the order in which they are named. Their curative power is exerted through the same channels as that of hot air, but here, as in some other conditions, it is much less profound, hence not so effective when used alone.

CHAPTER XIX.

MISCELLANEOUS CONDITIONS.

In the preceding chapters the different phases of the physiological action and clinical results of hot-air applications have been discussed with sufficient thoroughness to render apparent what effects may be expected to follow their use in most of the pathological conditions commonly encountered, and how these effects are produced. In the affections which remain to be considered, therefore, the subject will need to be treated but briefly.

Gallstones.

Hot air will not relieve the pain of ordinarily severe hepatic colic, and I know of nothing but morphine that will. Sometimes, however, the calculi already formed can be gotten rid of and the formation of new ones prevented by the use of body hot-air treatments in combination with electricity and the administration of appropriate drugs. The result is attained, of course, through the influence of the measures in correcting the impairment of liver function, by reason of which impairment cholesterol crystals are deposited, whereas they should normally remain in solution. The following is a case in point.

A lady, forty years old, had sustained her first attack of hepatic colic a year and a half before she consulted me. She had had several attacks since then, and the interval between them had never been more than three months. During the four months preceding her consultation with me they had pros-

trated her about once every four weeks. She had been given appropriate drugs and her diet had been wisely regulated, but no effect was evident upon the calculus formation. The attacks were growing more frequent and more severe. Her digestive and assimilative functions were greatly impaired, and marked general nervous debility was present. She had lost twenty pounds in weight during the preceding six months.

She was admitted to the sanitarium, her treatment consisting of body hot-air applications three times weekly, galvanization of the spinal cord with the negative electrode over the solar plexus twice weekly, and static electricity twice daily except on the days when hot air or galvanism was administered, when one of the static applications was omitted. The static modalities used were sparks to the spine, general surface of the body, and over the liver and gall-bladder in the morning, and the wave current localized over the liver at night. She was given sodium phosphate in five-gram doses three times daily, magnesium sulphate for her constipation when necessary, and the diet was restricted to plain, easily digested food, with meat fats, pastries, and sweets carefully eliminated.

Her general condition began to improve immediately, and continued to do so for three weeks. She then began to complain of premonitory symptoms of an attack of colic, and three days later was prostrated by the worst seizure of the sort that I have ever witnessed, which lasted for three days. Her fæces were washed and fifteen calculi recovered, varying in size from that of the head of a pin to that of a pea.

She was kept under the same treatment for three weeks more and then sent home for two weeks, at the end of which time she was admitted for another course of three weeks. For the following six months she was given two weeks' courses of the same treatment at intervals of three and four weeks. She had

no more attacks, and her general condition steadily improved, until at the end of that time she felt and apparently was entirely well, and has remained so ever since.

None of the cases have yet been under observation long enough to demonstrate whether or not the beneficial results will be permanent, but the outlook at present is very bright.

Gangrene.

Gangrene is most commonly due to a cutting off of the circulation of the part affected, as in embolism; or extensive impairment of the nutrient function of the blood vessels supplying the part affected, as atheroma, for instance, dependent upon some constitutional degeneration, and exemplified in senile gangrene of the extremities. The condition also obtains occasionally in some grave constitutional diseases, as diabetes mellitus.

Dry hot-air treatments, both body and local, are of great assistance in combating gangrene, but, as would be expected from the character and profundity of its physiological action, the body treatment is the most efficient. That the local treatment alone is capable of removing the affection most satisfactorily in some cases, however, is demonstrated by the result attained in the following instance, which was reported by Morse in the *New England Monthly* for May, 1898.

“Mr. D. Fargo, aged seventy-nine years, farmer by occupation, was attacked with gangrene (senile) in the left foot. There is nothing in his personnel or family history worthy of any particular mention or having any bearing on the case. Patient, while cachectic-looking, weak, and apparently in a precarious state of health, showed no other organic trouble, save the heart—lungs, stomach, liver, apparently, being normal. Urine contains some earthy phosphates, but no albumin or

sugar. Patient noticed his trouble first in August, 1897. His family physician made no particular diagnosis and on that account refused treatment.

“Physical examination of the two middle toes, which were affected, revealed quite a deep ulcerative process, involving also the adjacent structures of the dorsal side of the foot. Aside from the general sloughing the toes were practically dead. Poultices, cauterization, and antiseptics proved of no avail. Amputation was out of the question, on account of the existing heart trouble (mitral insufficiency), which was quite pronounced. Then decided symptoms of blood poisoning set in. Add to this the general weakness, due to disease and age, and it was evident that any harsh surgical procedure would almost to a certainty be followed by shock and death.

“All I could do was to dissect away the sloughing tissue and treat the wound antiseptically. The condition assumed a worse form, the leg becoming œdematous from the knee down and hyperæsthetic. Constitutional treatment was prescribed, but all to no avail. I despaired of the case and gave an unfavorable prognosis.

“Then an idea struck me—would intense dry heat not alter the local condition? I had previously investigated this agent for rheumatic and articular affections, and immediately ordered an apparatus from Frank S. Betz. On arrival of the apparatus the limb up to the lower third of the thigh was wrapped in a towel and put into the cylinder, and the air within heated gradually to 350° F. Two treatments a day were given, the temperature reaching later 400° F., for two weeks. Continuous observation proved a decided diminution of the œdema, healing by granulation of the sloughed tissues and improvement of the constitutional septicæmic symptoms.

Patient was discharged cured in two weeks, to everybody's surprise, and at the time of writing is working on his farm."

Angina Pectoris.

The writer has treated one case of true angina pectoris with hot air. In this instance the cause was probably calcareous degeneration of the coronary arteries or of the aorta. When the patient came under treatment he was unable to walk half a block or go up a flight of stairs without provoking an attack, and was utterly incapacitated for performing his ordinary daily duties. After a six weeks' course of body treatments he had improved to such an extent that he resumed his business duties again. He would sometimes be entirely free from pain for two days at a time and when it did obtain it was not severe enough to demand opiates. He then discontinued his treatment, but I still see him occasionally and he reports himself as having slowly, but steadily, improved.

I exercised the utmost care in administering the treatments to this patient, watching the heart action and subjective phenomena very closely. When the pulse had been accelerated to 110 beats per minute the pain would always begin to appear, and if the treatment was continued it would soon rise to an excruciating intensity, compelling the patient to sit up in the apparatus. When the heat was turned off, however, the pain would begin to subside as soon as the pulse got below 110, and I soon adopted the plan of turning off the heat as soon as the pain put in an appearance, without any reference to the amount of hyperthermia induced. No alarming symptoms obtained at any time.

It would seem, from its power of influencing atheroma of the general arterial system, that body hot air would be of use in treating angina pectoris dependent upon this ætiological factor, and the result obtained in this case gives color to the supposi-

tion. In view of the almost absolute lack of practical experience with it in this disease, however, and because of the characteristic effect of body hot air upon the circulatory system, it should be used with the utmost caution until enough experience has been gathered to make a reliable judgment possible.

Pseudo-angina is most frequently dependent upon general nervous debility or stomach trouble of some sort, and they often go hand in hand ætiologically. Body hot-air treatments are usually most efficient in removing both cause and effect in combination with other appropriate measures, especially static electricity. The writer has succeeded in curing entirely patients who had suffered with the affection for five years, and who had exhausted every other known measure of therapeusis.

La Grippe.

The body treatment, applied every other day at a temperature of 350° F., will usually completely eradicate the disease in from four to eight days. The first séance will extinguish the pains entirely, and they will rarely return; the bronchial and nasal symptoms respond at once, and the prostration will have disappeared inside of twenty-four hours to such an extent that the patient can often return to his occupation at once. Comfort is secured immediately, and the slow convalescence, extending over a period of weeks not infrequently under other methods of treatment, is encountered with the utmost rarity when the affection is combated with hot air. The temperature usually continues slightly elevated for a day or two. The writer can say with a conviction born of personal experience that the field of therapeutics offers few more delightful and satisfactory possibilities than are realized by the treatment of influenza with body hot air.

Syphilis.

A few patients suffering from this affection have been treated with hot air and have responded well. Corwin reports a case of multiple syphilitic arthritis which had resisted other therapeutical measures for several months as cured in three months by local hot-air applications in combination with potassium iodide internally. Relief of pain was immediate and permanent. The body treatment is the application that should be used generally in this disease, and mercury or potassium iodide according to indication, should be thoroughly administered in combination therewith. The general tonic effect of this measure, exerted through its influence upon assimilation, metabolism, and elimination, affords good grounds for the hope that its addition to the therapeutical armamentarium of syphilis will enable us to shorten materially the period of time during which it is now necessary to keep these victims under treatment in order to effect a cure.

Alcoholism.

A glance merely at the physiological action of body hot air will demonstrate its exquisite applicability to ordinary cases of alcoholism. I know of no agent that will so effectually allay the nervous symptoms, produce such refreshing sleep, and place the patient so quickly upon his feet.

The induction of the phenomena of overstimulation is sometimes very easy in these cases; the pulse and temperature go up very quickly, and the patient must be watched very closely during the first and second treatments. A fifteen-minute séance with a temperature of 275° F. is sometimes all that it is judicious to administer, and the writer has seen a pulse of 160 beats per minute and an increase of 3° F. in the body temperature follow even this mild application. In other cases,

on the other hand, the séance will have to be prolonged; the idiosyncrasies of each individual patient will have to govern on these points. Regulation of the ingesta and the administration of drugs should accompany the hot-air applications as indicated.

Dysmenorrhea.

The pain during the attack can ordinarily be greatly relieved and sometimes entirely removed by the use of the body treatment at the time. I have known functional dysmenorrhea of long standing to be relieved for months after a course of body hot-air treatments given for some other affection. When the trouble is due to structural peculiarities or organic pathologies of the pelvic organs, however, nothing of course will produce a permanent cure but surgical measures. C. Stuart Hutchinson, during the course of an address to The Central District Medical Association of Iowa in 1900, speaks of body hot-air treatments in this condition as follows:

“Dysmenorrhea due to the neuralgic or rheumatic diathesis, inflammation within the pelvis and parenchymatous nephritis, may be relieved by increasing the elimination through the skin and bowels. Repeated baths cause functional hypertrophy of the sweat-glands and eventually enable them to do more work. In colds the congestion of the nasal mucous membrane can be relieved by one treatment. Syphilitics obtain the same result as from the Hot Springs.”

The majority of the common organic and structural, as well as functional, causes of dysmenorrhea can ordinarily be removed more efficiently by appropriate applications of galvanic, faradic, and static electricity in combination with hot air, than by any other measures, surgical or medicinal. It must be administered, however, by one who is experienced and skillful

in this field, and good judgment must be exercised as to the applicability of the agent to the individual case.

Myositis.

Most commonly encountered during the course of the acute infectious diseases and as the result of traumatism. The local application will usually prove most satisfactory for its management, relieving the pain and spasmodic tendencies at once. It may be applied every twelve hours for the first two days and once daily thereafter until the muscle has regained its normal condition.

Osteomyelitis.

Burwash has reported two cases occurring during the course of typhoid fever as cured by local hot-air treatments. He concludes his report as follows:

“Osteomyelitis is always a very grave disease; the prognosis is so uncertain in any case that the physician is placed in a position of such great responsibility that he feels his helplessness, so that any treatment that will give relief to this serious disease in the first stages is eagerly adopted. The early operative treatment by cutting down through the bone and into the medullary cavity to remove the focus of inflammation and disease is often the only hope for an early extirpation of the disease, but this procedure is not always an easy matter for the surgeon to adopt in private practice.

“The hot-air treatment does not interfere with an operation if suppuration develops, while it may be the means of completely arresting the disease in the first stage, and thus obviate the necessity of an operation.”

Periosteitis.

When caused by traumatism, this inflammation can frequently be cured by the local application alone, but the

writer has seen such gratifying results follow the use of the body treatment that he prefers the latter in the majority of instances. Some cases will not yield until the body treatment has come upon the scene. The aid of the latter should always be invoked when the periosteitis is due to infection, or is of constitutional ætiology.

Muscular Adhesions.

Occasionally met with after fracture of the long bones, where the muscles about the seat of the injury have been lacerated by the ends of the fragments. The local treatment is usually all that is necessary for removing the trouble, but the body application constitutes a powerful reserve when the former proves inefficient. Massage, the static wave current, and galvanism are also efficient in this situation.

Skin Diseases.

The ætiology of the majority of the pathological processes which commonly affect the integument would lead to the belief that hot air would be immediately useful in their treatment. Experience demonstrates that this is occasionally so, but in the bulk of the cases so far treated, especially in eczemas, marked benefit has not appeared until several weeks and sometimes months after the agent was applied. This may be looked upon as an indication of the fact that in these cases impairment of the trophic nerve centers played a leading part in their ætiology, hence the skin disease could not be removed until the general metabolic functions had been gotten upon an efficient basis.

Walsh reports an interesting case of eczema of both hands of long standing. One hand only was subjected to the hot-air treatment, but both hands got well; a very pretty illustration

of the reflex influence exerted by this agent. The evidence now at hand indicates that both body and local hot-air applications, but especially the body, will prove to be of considerable assistance in the management of skin diseases in the future.

Plumbism.

The following is reported by Corwin:

"Philip B., Italian, aged forty-two. Admitted with diagnosis of plumbism, which had not reached paralytic stage, but muscles crampy. One full bath relieved above conditions, and after four baths patient was discharged well."

The administration of potassium iodide or whatever other drugs are indicated should accompany the hot-air treatments.

Typhoid Fever.

Up to the present time less than half a dozen cases of typhoid have been subjected to dry hot-air therapeutics, hence the time is not ripe for judgment as to its influence over the primary infection *per se*; but it is very useful in some of the conditions that obtain during the course of the disease. Myositis, neuritis, and neuralgia, occurring in situations other than about the head, are readily amenable to the local application, and the exhaustion, always threatening and frequently eventuating in dissolution, which sometimes occurs late in the disease, can be controlled, at least in some cases, by the body treatment. The writer has seen life saved under these conditions when the patient's extremities were cold and clammy nearly to the trunk, the facies Hippocratica present, pulse running from 150 to 160 beats per minute, a temperature of 106° F. obtaining, and the sufferer entirely unconscious. The immediate effect of the treatment was to re-establish the circulation in the extremities, bring back the color to the face,

and to strengthen the pulse and heart-action to an astonishing degree. The body temperature was increased half a degree by the treatment, but it dropped to 105° F. within two hours, and the patient began to improve after the second treatment, given twelve hours later, eventually recovering from one of the worst attacks of typhoid that I have ever witnessed. She had, altogether, five body treatments, and I am fully persuaded that she would have died had it not been for hot air.

Another very pretty instance of the stimulating influence of this agent is the manner in which it overcomes the collapse which sometimes follows cold baths. Cold baths exert their beneficial influence through a stimulation of the deep spinal reflexes, but sometimes the nervous system is too much overwhelmed by typhotoxin to be able to react, and depression results. Body hot air exerts its beneficial influence in the same way, but never under any circumstances is its judicious, skillful administration followed by secondary depression. It is worthy of more extensive trial, and the facts already at our command afford grounds for the hope that it will prove to be of considerable use in the treatment of this affection in the future.

The phenomena of overstimulation are easy of induction in this situation, and the utmost care must be exercised in the administration of the agent not to exceed a limit appropriate to the individual case. The pulse and body temperature are valueless as guides to the duration and intensity of the treatment, and the general response on the part of the patient must govern. The art which is the result of experience is invaluable in this connection.

Obesity.

Body hot-air treatments have been lauded as a remedy for obesity, but the writer has never seen them reduce

weight markedly or permanently, unless a regulation of diet accompanied their administration. I have not yet been able to convince myself that hot air increased the effect obtainable with dietary regulation and exercise, and am unwilling at the present time to speak very strongly in its favor as a remedy for this condition.

CHAPTER XX.

CONCLUSION.

Dry hot-air therapeusis is as yet in its infancy, but its physiological action and what has been demonstrated in the way of clinical results up to the present time indicate the lines upon which future experimental work may be conducted. Enough has already been accomplished to establish the agent upon a sound basis as a permanent element in our therapeutical armamentarium. Its powers are exhibited in fields but inefficiently covered by other measures, and the character of its beneficial activity is such as to indicate an extended scope of usefulness in the future. In the field of future possibilities may be mentioned the following ailments.

Erysipelas.

In Bulgaria it is a common domestic practice to treat erysipelas by holding a red-hot iron or a bare flame close enough to the part affected to scorch the integument, producing a burn of the first degree. Tregubow has adopted this treatment, using the flame of a spirit lamp or of a bit of burning cotton which had been previously dipped in alcohol, as the cauterizing instrument, and reports gratifying results. This fact would suggest the use of dry hot-air applications in this disease, and the marked benefit which results from their use in other local septic infections affords reasonable grounds for hoping that they may prove useful here. The principles of application and technique would be the same as those described in the section upon local septic infection.

Lupus.

Werther and Lichtwitz have reported good results from the use of dry hot air in the treatment of lupus. They employ a temperature of from 150° F. to 250° F. Werther has found the treatment to be very painful and administers a general anæsthetic, but the experience of Lichtwitz has been diametrically opposed to this. The physiological action of hot air and the results of its use in other infections would suggest its application to cases of this disease. The recent remarkably favorable reports of the results obtainable with X-ray therapy in this connection, however, bid fair to displace, for a time at least, almost all other methods of dealing with the affection, and hot air will probably not be investigated in this connection further at present.

Surgical Shock.

One of the means most depended upon for the relief of this condition is the application of heat by means of the hot pack, hot-water bottles placed about the body, etc. By using a body hot-air apparatus, heat can be applied not only much more easily, but the degree of elevation can be maintained with great uniformity, and the application can be made intense enough to produce a degree of stimulation which, as has already been stated, is not surpassed and probably not equaled by any other measure now known. In addition to this no vicious reaction is to be feared, and it is probable that the body hot-air apparatus will be as familiar an adjunct to the surgical operating room of the near future as is the operating table, to-day.

Hodgkin's Disease.

The increase in the number of red blood cells dependent upon the application of the body treatment, to-

gether with its powerfully stimulant influence upon cell activity and vitality, would seem to rationally indicate its use in this affection. Color is further lent to this supposition by the very satisfactory manner in which hot air disposes of localized cultures of the tubercle bacillus in other situations, as in joint tuberculosis. Appropriate drug tonics should also accompany the hot air.

Multiple Neuritis.

Multiple neuritis is dependent upon a variety of causes, many of which exhibit exquisite possibilities for the body treatment in combination with other appropriate measures, and the affection is usually troublesome enough, both as regards chronicity and suffering, to assure a hearty welcome for any agent that will increase our present ability to overcome the trouble.

Tabes Dorsalis.

Tabes dorsalis and other nervous diseases characterized by degenerative tendencies offer a field for apparently fruitful investigation, especially in their early stages. It has already been demonstrated that skillfully applied, appropriate, static electrical modalities will apparently cure some cases of tabes in its early stages. Hot air acts in much the same way as electricity, but much more profoundly and permanently in some conditions, and diseases of this nature would seem to constitute one of these conditions.

Diabetes Mellitus.

Diabetes mellitus is a disease one of the most prominent characteristics of which is suboxidation. This, as well as most of the other symptomatic phenomena, constitutes an ex-

quisite indication for the induction of the effects of thermotherapy upon the trophic and metabolic functions.

Some mental diseases, as paresis, which frequently have their origin in constitutional degenerations or excessive nerve strain, ought to be amenable in some degree to thermotherapy, at least in their early stages. The writer has seen one case of commencing paresis which indicates that a curative result may not be impossible of attainment, and he hopes to see investigations on this line instituted in the insane asylums in the near future. Time thus spent would not be wasted even if no benefit in the mental state followed, as the general physical condition of the patients thus treated would be improved.

The Infectious Diseases.

In typhoid fever the employment of the body treatment has already been alluded to, and its effects in this ailment would suggest that it might be useful in other diseases of this class. The writer has applied it to one case of measles occurring in a man thirty-eight years old, with most gratifying results. The rash developed with great rapidity and profusion, and disappeared entirely together with the other symptoms of the disease, which had existed with a moderate degree of severity, in four days after the treatment was instituted, when the patient was discharged cured. This is an encouraging showing when we consider the severity of an ordinary case of measles occurring in adult life. The great profuseness of the rash and the rapidity with which it developed in this case would indicate that influence upon the function of elimination played a large part in the production of the beneficial results.

The local application to the cavities of the body will also probably prove to be useful. It has already been employed to

some extent in the external auditory canal in acute otitis media, with reported beneficial results, but nothing definite or conclusive can yet be said in this connection. The field, however, is hopeful, and the belief is held by those who have used it in these situations that "the future has good tidings in store."

INDEX.

A

- Alcoholism, 182
 - Treatment of,
 - Body hot-air application in the, 182
 - Diet in the, 183
 - Drugs in the, 183
- Alkalies in rheumatism, 59
- Anchylosis, bony, in arthritis deformans, 96
- Angina pectoris, 180
 - Body hot-air application in the treatment of, 180
 - Illustrative case, 180
- Apparatus, 15
 - Different forms of, 15
 - Essentials common to all forms of, 19
 - For applying dry hot air to open cavities, 20
 - General construction of, 15
 - Knee, 19
 - Maintenance of dryness of air in, 19
 - Thermic equalization inside of, 19
 - Body, essentials in construction of, 15
 - General local, essentials in construction of, 15
- Appendicitis, 141
- Arthritis deformans, 72
 - Clinical phenomena of, case illustrating, 91
 - Diagnosis of, 75
 - Etiology of, 75
 - Treatment of, 82
 - Drugs in the, 86
 - Electricity in the, 85
 - Hot air in the, 82
 - Technique in the hot-air applications in, 82
 - X-light in arthritis deformans, 88
- Aspirin in rheumatism, 58

B

- Baume Analgesique (Bengue)
 - In arthritis deformans, 86
 - In pneumonia, 114
- Bismuth subnitrate
 - In arthritis deformans, 87
- Blood poisoning. See local septic infection.
- Body dry hot-air application
 - Effect upon blood composition of, 25
 - Effect upon body temperature of, 26
 - Capillary circulation of, 27
 - Pulse of, 26
 - Respiration of, 27
 - Urea excretion of, 26
 - Urinary secretion of, 25
- In alcoholism, 182
 - angina pectoris, 180
 - arthritis deformans, 82, 88
 - chronic bronchitis, 170
 - diabetes mellitus, 191
 - dysmenorrhea, 183
 - fibrous ankylosis, 175
 - gall stones, 176
 - Hodgkin's disease, 190
 - la grippe, 181
 - lithæmia, 158
 - local septic infection, 116
 - mental diseases, 192
 - multiple neuritis, 191
 - muscular adhesions, 185
 - myalgia, 163
 - myositis, 184
 - nephritis, 100
 - nervous debility, 166, 167
 - neuralgia, 161
 - neuritis, 169
 - obesity, 187
 - paresis, 192
 - periosteitis, 184
 - peritonitis, 147

Body dry hot-air application
 In pleuritis, 150
 plumbism, 186
 pneumonia, 130
 pulmonary tuberculosis, 171
 rheumatism, 57
 skin diseases, 185
 surgical shock, 190
 synovitis, 154
 syphilis, 182
 tabes dorsalis, 191
 the infectious diseases, 192
 typhoid fever, 186
 varicose ulcers, 164
 Physiological action of, 25
 Sensation of, 27
 Technique of, 82
 Burwash, H. J., 142, 184

C

Calomel
 In nephritis, 102
 Carminatives
 In arthritis deformans, 87
 Charcoal
 In arthritis deformans, 87
 Chloride of gold and sodium in arthritis deformans, 88
 Cholelithiasis. See gall stones.
 Chronic bronchitis, 170
 Treatment of
 Body hot-air application in the, 170
 Drugs in the, 170
 Electricity in the, 170
 Local hot-air applications in the, 170
 Ozone inhalations in the, 170
 Coal-tar derivatives
 In arthritis deformans, 87
 neuritis, 169
 Cod liver oil in arthritis deformans, 88
 Corwin, R. W., 102, 151, 182, 186

D

Diabetes mellitus, body hot-air application in the treatment of, 191
 Diet
 In alcoholism, 183
 lithæmia, 158

Diet

In local septic infection, 108
 nephritis, 101
 nervous debility, 167
 neuritis, 170
 obesity, 188
 rheumatism, 61

Digestive ferments

In arthritis deformans, 87
 local septic infection, 108

Drugs

In alcoholism, 183
 arthritis deformans, 86
 chronic bronchitis, 170
 gall stones, 176
 local septic infection, 108
 nephritis, 102
 neuralgia, 162
 neuritis, 169
 plumbism, 186
 rheumatism, 58
 syphilis, 182
 varicose ulcers, 165

Dysmenorrhea

Body hot-air application in the treatment of, 183
 Uterine pathology in the causation of, 183

E

Electricity

In arthritis deformans, 84, 89
 chronic bronchitis, 170
 fibrous adhesions, 175
 gall stones, 176
 lithæmia, 159
 local septic infection, 108
 muscular adhesions, 185
 myalgia, 163
 nephritis, 102
 nervous debility, 167
 neuralgia, 162
 neuritis, 169
 peritonitis, 147
 pulmonary tuberculosis, 174
 rheumatism, 60
 sciatica, 64
 sprains, 70
 synovitis, 155
 tabes dorsalis, 191
 uterine pathology, 183
 varicose ulcers, 164

Erysipelas

- Dry hot-air treatment of, 189
- "Scorching" treatment of, 189

F**Fibrous ankylosis, 175**

- Treatment of
 - Body hot-air application in the, 175
 - Electricity in the, 175
 - Local hot-air application in the, 175
 - Passive motion in the, 175

Fibrous adhesion. See Fibrous ankylosis and Muscular adhesion.**Fibrous adhesion in rheumatism, 62****Friedlaender, R., 104****Future possibilities of dry hot-air therapeutics, 189****G****Gall stones, 176**

- Illustrative case, 176
- Treatment of
 - Drugs in the, 176
 - Electricity in the, 176
 - Hot air in the, 176

Gangrene, 178

- Hot air in the treatment of, 178
- Illustrative case, 178

Gout, true, 159

- Local hot-air application in, 159

H**Heart failure in pneumonia, 131****Hodgkin's disease, 190**

- Treatment of
 - Body hot-air application in the, 190
 - Drugs in the, 191

Hutchinson, G. S., 183**I****Infectious diseases, body hot air in the treatment of, 192****Iodide of potassium in arthritis deformans, 88****Iron in arthritis deformans, 88****K****Kinnear, Beverly C., 123****L****La Grippe, 181**

- Body hot-air application in the treatment of, 181

Lead poisoning. See plumbism.**Lichtwitz, L., 190****Lithæmia**

- Restriction of term, 156

Treatment of

- Body hot-air application in the, 158

Diet in the, 158**Electricity in the, 159****Hydrotherapy in the, 159****Salines in the, 159****Local dry hot-air application in arthritis deformans, 84****chronic bronchitis, 170****erysipelas, 189****fibrous ankylosis, 175****gall stones, 176****local septic infection, 106****lupus, 190****muscular adhesions, 185****myositis, 184****nephritis, 100****neuralgia, 161, 162****neuritis, 168****osteomyelitis, 184****periosteitis, 184****peritonitis, 142****pleuritis, 150****pneumonia, 123****pulmonary tuberculosis, 173****rheumatism, 57****skin diseases, 185****synovitis, 153****syphilis, 182****varicose ulcers, 163****Influence upon local temperature of, 23****Local hyperæmia in, 24****Perspiration in, 24****Physiological action of, 23****Reflex influence of, 24****Local Septic Infection, 104****Treatment of, 106****Dry hot air in, 106**

- Local septic infection
 - Treatment of, Drugs in, 108
 - Electricity in, 108
 - Operative interference in, 108
- Lupus, 190
 - Dry hot-air treatment of, 190
 - X-ray treatment of, 190
- M**
- Magnesium sulphate
 - In arthritis deformans, 87
 - local septic infection, 108
- Massage
 - After local hot-air application, 42
 - In rheumatism, 57
 - sprains, 69
- Measles
 - Body hot air in the treatment of, 192
- Mental diseases
 - Body hot air in the treatment of, 192
- Methyl salicylate in rheumatism, 59
- Mineral waters
 - In arthritis deformans, 87
- Morse, 178
- Multiple neuritis
 - Body hot-air application in the treatment of, 191
- Muscular Adhesions, 185
 - Treatment of
 - Body hot-air application in the, 185
 - Local hot-air application in the, 185
- Myalgia, 163
 - Treatment of,
 - Body hot-air application in the, 163
 - Electricity in the, 163
- Myositis, 184
 - Local hot-air application in the treatment of, 184
- N**
- Nephritis, 98
 - Diet in, 101
 - Drugs in, 102
 - Electricity in, 102
 - Hot air in, 100
 - Pathology, 98
 - Treatment of, 100
- Nerve stretching in sciatica, 65
- Nervous debility
 - Treatment of,
 - Body hot-air application in the, 166
 - Change of scene in the, 167
 - Diet in the, 167
 - Electricity in the, 167
 - Exercise in the, 167
- Nervous exhaustion. See nervous debility.
- Neuralgia, 160
 - Causative factors of, 160
 - Treatment of, 161
 - Body hot-air application in the, 161
 - Drugs in the, 162
 - Electricity in the, 162
 - Local hot-air application in the, 161, 162
- Neurasthenia. See nervous debility.
- Neuritis, 168
 - Causation of, 168
 - Treatment of, 168
 - Diet in the, 170
 - Drugs in the, 169
 - Electricity in the, 169
 - Hot air in the, 168
- New York Medical Journal, 135
- O**
- Obesity, 177
 - Treatment of,
 - Body hot-air application in the, 177
 - Diet in the, 188
 - Exercise in the, 188
- Operative interference
 - In appendicitis, 141
 - dysmenorrhea, 183
 - local septic infection, 108
 - neuralgia, 162, 163
 - osteomyelitis, 184
 - peritonitis, 140, 147
 - peritonitis, tuberculous, 141
 - pleuritis, 149
 - sciatica, 65
 - tuberculous synovitis, 142
- Opium
 - In arthritis deformans, 87
- Osteomyelitis, 184
 - Hot air in the treatment of, 184
- Ozone Inhalations
 - In chronic bronchitis, 170

Ozone inhalations
 In pneumonia, 133
 pulmonary tuberculosis, 173

P

Periosteitis, 184
 Treatment of,
 Body hot-air application in the, 185
 Local hot-air application in the, 184
 Peritonitis, 135
 Illustrative case, 135
 Treatment of, 142
 Hot air in the, 142
 Electricity in the, 147
 Operative interference in the, 147
 Tuberculous, 141
 Physiological action
 Of body hot-air application, 25
 local hot-air application, 23
 Pleuritis, 149
 Body hot-air application in, 150
 Local hot-air application in, 150
 Treatment of, 150
 Varieties of, 149
 Plumbism, 186
 Treatment of,
 Body hot-air application in the, 186
 Drugs in the, 186
 Pneumonia, 110
 Absorption of exudate by the hot-air application in, 115, 118, 133
 Baume Anelgesique in, 114
 Bryonia in, 133
 Calomel in, 132
 Creosote carbonate in, 132
 Drugs in, 132
 First use of the hot-air applications in, 110
 Heart failure from, 131
 Body treatment in, 131
 Hyperpyrexia in, 131
 Local hot-air applications in, 123
 Oxygen inhalations in, 133
 Pathology of, 110
 Phosphorus in, 133
 Quinine in, 133
 Salicylates in, 132
 Sanguinaria in, 133
 Sanguinarin in, 133

Pneumonia

Strychnia in, 133
 Tartar emetic in, 133
 Treatment of, 123
 Whisky in, 133
 Pulmonary tuberculosis,
 Treatment of,
 Body hot-air application in the, 171
 Electricity in the, 174
 Inhalations of ozone in the, 174
 Local hot-air application in the, 173
 Sanitaria in the, 171
 X-light in the, 173

Q

Quinine in arthritis deformans, 88

R

Rheumatism, 54
 Chronic, 62
 Importance of correct diagnosis of, 54
 Treatment of
 Advantages dependent upon the use of hot air in the, 66
 Diet in the, 61
 Drugs in the, 58
 Electricity in the, 60
 Hot-air applications in the, 57
 Rest in the, 57

S

Salicin in rheumatism, 58
 Salicyclic acid
 In arthritis deformans, 88
 rheumatism, 58
 Salines
 In arthritis deformans, 87
 lithæmia, 159
 nephritis, 102
 Salophen
 In rheumatism, 59
 sciatica, 63
 Salpingitis, 140
 Schreiber, J., 19
 Sciatica
 Treatment of, 63
 Electricity in the, 64
 Hot-air applications in the, 63
 Salicyl compounds in the, 63

- Skin diseases, 185
 Treatment of
 Body hot-air applications in the, 185
 Local hot-air applications in the, 185
 Smith, Andrew H., 110
 Snow, William Benham, 84
 Sodium salicylate in rheumatism, 59
 Sprains, 68
 Treatment of, 68
 Advantages dependent upon the use of hot air in the, 70
 Elastic bandage in the, 69
 Electricity in the, 70
 Hot-air applications in the, 68
 Liniments in the, 69
 Strychnia sulphate
 In arthritis deformans, 88
 local septic infection, 108
 nervous debility, 166
 Synovitis, 151
 Treatment of, 153
 Body hot-air application in the, 154
 Elastic bandage in the, 154
 Electricity in the, 155
 General local apparatus in the, 153
 Immobilization in the, 154
 Varieties of, 151
 Surgical shock, body hot-air application in the treatment of, 190
 Syphilis, 182
 Body hot-air application in the treatment of, 182
 Local hot-air application in the treatment of, 182
- T
- Tabes dorsalis, body hot-air applications in the treatment of, 191
 Technique, 29
 Coverings, 29
 General, 29
 In arthritis deformans, 82
 rheumatism, 57
 sprains, 68
 Of body hot-air application, 42
 In alcoholism, 182
 angina pectoris, 180
 arthritis deformans, 82
- Technique
 In la grippe, 181
 lithæmia, 159
 local septic infection, 106
 nephritis, 100
 peritonitis, 147
 pleuritis, 150
 pneumonia, 130
 typhoid fever, 187
 Of local hot-air application, 30
 In local septic infection, 106
 peritonitis, 142
 pleuritis, 150
 pneumonia, 123
 rheumatism, 57
 sciatica, 63
 sprains, 68
 varicose ulcers, 163
 Knee application, 51
 Phenomena indicating excessive stimulation, 49
 Pulse and temperature as guides in, 48
 Tissue remedies in arthritis deformans, 88
 Tregubow, 189
 Typhoid fever, 186
 Treatment of
 Body hot-air application in the, 186
 Cold baths in the, 187
- V
- Varicose ulcers
 Caustion of, 163
 Treatment of, 163
 Drugs in the, 165
 Electricity in the, 165
 Hot air in the, 163
- W
- Walsh, J., 159, 185
 Werther, 190
- X
- X-light
 In arthritis deformans, 79
 intra - abdominal malignant growths, 140
 lupus, 190
 pulmonary tuberculosis, 173

1

LANE MEDICAL LIBRARY

To avoid fine, this book should be returned on
or before the date last stamped below.

--	--	--

U865 Skinner, Clarence E.
S628 Therapeutics of di.
1902 hot air 16607

[illegible]

